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PHYSIOLOGICAL INVESTIGATIONS IN THE FLYING SAFETY PROGRAM OF THE FLYING TRAINING AIR FORCE

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THE subject for today is one in which we are all vitally interested, namely, flying safety.

I came to the Flying Training Air Force (FTAF) when it was first organized in 1951, and since then everyone in my office has been working closely with our Flying Safety people, with our Training and Operations Section, with our Base Commanders, and also with our Commanding General in an effort to reduce the aircraft accident rate. This accident rate has fallen from a high of 56.2 per 100,000 flying hours in 1951 to a low of 10.4 in 1956. In the Surgeon's Office, we have been working along the lines of physiological investigation to improve flying safety. The methods we have used in helping reduce our accident rates will be presented.

The importance of hypoxia[1] as related to the safety of flying personnel is well recognized, and elaborate measures have been taken to prevent it. Two other conditions which are physiologically abnormal, the symptoms of which may be confusing or add to the symptoms of the hypoxic syndrome, are hyperventilation with hypocapnia and hypoglycemia, or relative hypoglycemia.

HYPERVENTILATION

Hyperventilation in an aviator, according to Lillehei and Balke,[2] if progressive, may reduce the carbon dioxide below a critical

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From Flying Training Air Force, Waco, Tex.

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level which results in performance impairment, tetany, and unconsciousness. These authors found that lowering the alveolar carbon dioxide tension below 25 mm of mercury by voluntary hyperventilation in normal young men caused a significant impairment of psychomotor performance as tested on the Air Force Complex Coordinating Apparatus. In addition, tetany with severe spasms of the wrists and fingers resulted when an average of 3.5 liters of carbon dioxide per square meter of body surface area were lost from the body reservoir.

Balke, Wells, and Clark,[3] continuing the work on hyperventilation at the U. S. Air Force School of Aviation Medicine, confirmed the findings of the earlier study and added that susceptibility to hyperventilation varied greatly from individual to individual, some demonstrating severe tetany, others only slight tingling or no symptoms at all when exposed to the same experimental conditions. Of the 26 student pilots subjected to in-flight tests, it was observed that otherwise very efficient students made mistakes, became progressively confused, and showed low carbon dioxide values. Symptoms noted during mechanically induced hyperventilation in the laboratory are summarized in table 1. Despite these subjective and objective symptoms, it was apparent that "healthy young individuals in good physical condition have a good resistance to relatively severe degrees of hypocapnia. For that reason there will continue to be much speculation about the possibility of aircraft incidents or accidents caused by hyperventilation."

TABLE 1. *Symptoms noted in 14 subjects during mechanically induced hyperventilation*

Symptoms	Number of subjects	Per cent
Tingling	11	79
Dizziness	7	50
Tremor	6	43
Tightness of muscles	5	36
Carpopedal spasms	5	36
Inability to speak	3	21
Disturbance of vision	2	14
Neurocirculatory disturbances (sweating, chills, et cetera)	2	14
Drowsiness, sleepiness	1	7
Jerking of extremities	1	7

In 1952, Hall[4] found 53 cases of involuntary hyperventilation out of 695 exposures to a simulated altitude of 43,000 feet.

During pressure breathing it was also noted that the earlier symptoms of hypoxia and hyperventilation with hypocapnia are similar and confusing.

The work cited above, coupled with the earlier work of Hinshaw and co-workers[5,6] and Rushmer and Bond,[7] suggested strongly that some of our accidents were due to hyperventilation rather than to hypoxia. In order to get more specific information on the differential diagnosis, a Physiological Near Accident Report was instituted in our Command during the latter part of 1952.

During the spring of 1953, an incident occurred in one of our low-pressure chambers at a simulated altitude of only 8,000 feet. Inasmuch as hypoxia does not occur ordinarily at altitudes below 12,000 feet, the Flight Surgeon and the Aviation Physiologist in charge of this case were interviewed directly, and it was determined that the subject involved was observed to have had definite hyperventilation preceding his collapse.

A second incident, occurring some three months later, was also observed in a low-pressure chamber. The student undergoing indoctrination in aviation physiology was subjected to mild hypoxia by disconnecting his oxygen hose at 30,000 feet. This particular student insisted on leaving his hose disconnected longer than directed, and he very shortly collapsed, apparently from hypoxia. His oxygen supply was re-established and his recovery was prompt; however, he began breathing very rapidly and deeply, and at 27,000 feet he lost consciousness again, apparently this time from acapnia or a combination of acapnia and hypoxia. Each time during recovery hyperventilation was repeated, and the subject relapsed at 17,000 feet and again at 8,000 feet. This incident seems to confirm the possibility of hypoxia acting as a "triggering mechanism" for hyperventilation.

Following the two incidents outlined above, 64 Physiological Near Accident Reports were reviewed and the impression was gained that many of these could be charged to hyperventilation. In November 1953, we started an intensive indoctrination program regarding hyperventilation, emphasizing the symptoms, dangers, and preventive measures. It was thought that the young student aviator was predisposed to hyperventilation when, with his helmet and face mask in place, he was tightly strapped into the seat of a jet aircraft and the canopy closed with a "thump." He was further conditioned by formation flying at altitudes of 20,000 feet or higher so that any further increase in the stress factors might cause involuntary hyperventilation, with performance impairment and with resulting near accident or actual disaster. One student flying solo a T-6 aircraft reported to the tower that he was in trouble but landed safely through the efforts of an instructor flying wing, plus radio instructions from the Flight Surgeon. On landing, he explained that he could not grasp the

stick because his hands were like claws. Another student flying a PA-18 aircraft, with an instructor, found his hands frozen to the struts. After being landed by the instructor, it required 10 minutes and the efforts of two persons to free the student's hands.

In our indoctrination program young pilots are instructed, if flying under 10,000 feet when they begin to hyperventilate, to simply hold the breath as long as possible and then resume breathing near the normal rate of 14 per minute. When flying at altitudes where hypoxia can be a factor and it is necessary to differentiate between hypoxia and hyperventilation, the pilot is told to first turn his oxygen regulator to 100 per cent oxygen and take three breaths. If he is not improved, or possibly feeling a little worse, he should then try holding his breath as long as possible, and then resume at the normal rate of 14 per minute. It might be argued here, that taking three more breaths when already hyperventilating might be courting disaster. This has not occurred in our experience.

During the year 1953, before we began this type of briefing, there were 28 unexplained fatal accidents in jet aircraft in the Flying Training Air Force, or 1 fatality every 13 days. In 1954, after 1 year's indoctrination of the program outlined, there were only 8 unexplained fatalities, or 1 every 45 days. In 1955, there was only 1 every 72 days, and in 1956 there were only 2 unexplained fatal accidents. Other factors such as supervision, instruction, and maintenance undoubtedly have contributed to this improved safety record.

RELATIVE HYPOGLYCEMIA

Wiggers[1] defined hypoglycemia as a progressive decrease in blood sugar characterized, when it reaches the environs of 75 mg per cent, by weakness, trembling, nausea, and vomiting. Harrison and Finks[6] defined relative hypoglycemia as a metabolic disorder characterized by nervousness, weakness, palpitation, dizziness, dyspnea, arrhythmias and chest pain—occurring two or more hours after meals. These symptoms can usually be reproduced by insulin, relieved by the ingestion of glucose, and prevented by dietary regulation (high protein, low carbohydrate). Blood sugar is found usually slightly subnormal or normal. These authors pointed out that there is a great variation in individual susceptibility, some patients tolerating blood sugars as low as 40 mg per 100 ml without symptoms, while others experience difficulty at 65 to 70 mg per 100 ml.

Diabetics experience insulin overdose manifestations with blood sugars at or above the normal range, an example of relative hypoglycemia. Of the 31 patients observed with sugar tolerance tests by Harrison and Fink, 2 had blood sugar levels below 50 mg per 100 ml, 7 had 50-59, 11 had 60-69, 7 had 70-79, and 1 patient

had 80. The rapid descent of the curve, as well as the minimum level, seemed significant. The response to insulin in the reproduction of the symptoms was positive in 15 out of 18 patients tested and is regarded as a valuable diagnostic aid. The response to treatment with a high-protein, low-carbohydrate diet proved one of the most useful diagnostic procedures.

In treatment, the diet used by Conn[9] (low carbohydrate, high protein) was usually effective in contrast to high-carbohydrate meals with intermediate feedings. The high blood sugar produced by the latter regimen apparently produced excessive insulin production. Conn and associates[10] pointed out that after a high-protein meal, the blood sugar level is relatively stable because the protein is gradually converted to amino acids, which in turn are changed to glucose.

From observation of certain low altitude "near accidents" in the Air Force, supported by a limited number of laboratory tests, the conclusion was reached that these accidents might have the etiologic component of relative hypoglycemia. The following cases will serve to illustrate this possibility.

CASE REPORTS

Case 1. A student pilot became unconscious while flying with an instructor at an altitude of 8,000 feet. After the plane was landed by the instructor, the Flight Surgeon studying the cause of the student's failure did a six-hour glucose tolerance test, and at the end of three hours the blood sugar was reported as 53 mg per 100 ml.

Case 2. A young pilot flying solo in a jet plane reported blacking out for a short period at an altitude of only 1,700 feet. On recovering he found himself at an altitude of only 200 feet but was able to make a safe landing. This individual also was given a six-hour glucose tolerance test, and at the end of three hours a low point of 63 mg per 100 ml was reported.

Case 3. A young pilot in a T-33, during a landing about 2100 hours, neglected to turn on his landing lights and let his flying speed drop to below 100 knots. He failed to take proper corrective measures and his plane stalled, dropped 25 to 30 feet to the runway, bounced, and on the second contact with the ground, the landing gear collapsed. The pilot was unhurt and the Accident Investigation Board found the accident due to hypoxia. Subsequent inquiry from the Flying Safety Officer, however, gave the following information:

"This pilot attended a banquet the night before and had a meal, presumably a well-balanced one, at 1900. He did not get to bed until 0330 but arose at 0600. His breakfast consisted of a candy bar and a soft drink. He flew with a student for approximately 1 hour and 10 minutes. Between the time he landed and 1530, he had additional candy bars and soft drinks. He slept 1 hour during the afternoon, but prior to take-off he had no food except another candy bar and another soft drink."

We considered that a blood sugar deficiency in these three cases contributed to these hazardous conditions. We believe that relative hypoglycemia may play a definite part in some of our aircraft accidents. Certain cases with symptoms due to hypoxia, hyperventilation, and relative hypoglycemia may occur separately or in combination, and the pilot will be more susceptible if he has skipped a meal or has had only a high carbohydrate meal two or more hours previously. In flight, the pilot is subjected to both mental and physical stresses and glucose is imperative for cellular utilization of oxygen, and hence the proper function of the central nervous system. If the pilot eats a high-protein meal, including eggs and meat, his blood sugar level would be maintained at good levels for a much longer period because, as pointed out by Conn and co-workers,[10] these proteins will be converted to amino acids, which in turn will be changed gradually to glucose. With such a diet the pilot is maintained from meal to meal at relatively safe blood sugar levels.

In the Spring of 1955, a visit was made to all of our pilot training bases and our students were interviewed to find out just how many of them were not eating properly before flying. It was discovered that over 50 per cent of our students were not getting up for breakfast. They, consequently, were flying without an adequate breakfast, or with none at all, and laying themselves wide open for a pilot-error accident. This situation was discussed with the Commander of Flying Training Air Force and it was decided that something had to be done about it. In June 1955 we initiated a very intensive program to improve the eating habits of our young pilots. This was done by explaining to them *and their wives* the importance of a well-balanced breakfast, lunch, and dinner. It was explained to them that the protein foods—*eggs, meat,* and *milk*—are the most important elements in breakfast and other meals, and it is these protein foods that hold the blood sugar level relatively high for a long period of time. Our Headquarters also published a directive in which all of our flying students (cadets) as well as officers residing on the base, were required to eat at least two meals, breakfast and lunch, at one of the base messes. At the same time, a small snack bar was established in each of our flight briefing buildings. These snack bars were simple affairs, containing a refrigerator and a small counter. The foods stored in the refrigerator were milk, fruit juices, and good sandwiches—meats of all kinds and cheese. We discouraged the use of doughnuts in these snack bars since they consist primarily of carbohydrate and fat, which might contribute to overstimulation of the internal secretion of the pancreas. In fact, we believe that the best part of the doughnut is the hole in the middle. The snack bars were not open in the morning until after students had taken off on their first flight, for we did not want them to use this as a substitute for an ad-

equate breakfast. They were opened prior to the ending of the first flight so that students and instructors could get a bite to eat at a time when their blood sugar level could be expected to be at a comparatively lower level.

This program to improve the eating habits of our pilots has been in effect a little more than a year, and we have indications that it is succeeding. This is reflected in the accident rate. The accident rate for 1954 in Flying Training Air Force was 16.6, in contrast with the rate in 1955 which was 12. The reduction in 1955 occurred primarily in the latter part of the year, after the program had been initiated in June. The aircraft accident rate for the 6-month period was 10.8, which is considered low. In comparison, the aircraft accident rate for the rest of the Air Force, not including Flying Training Air Force, for 1955 was 23, or more than double the FTAF rate. The accident rate in 1956 was 10.4. Together with the reduction in the accident rate, we have had a reduction in the per cent of pilot-error accidents. In 1954 the per cent of such accidents was 67, in 1955 it was approximately 56, and in 1956 it was 47.2. Another indication is the fact that during the first 6 months after this program was started there was a 2-month period in which no fatalities occurred, the only 2 months since FTAF was organized in 1951 with no fatalities.

To all who are interested in studying the problems of hypoglycemia I make this recommendation: do not limit glucose tolerance tests to 2 or 3 hours. Carry them out to a full 6 hours. Abrahamson and Pezet[11] pointed out that some cases of hypoglycemia may present completely normal glucose tolerance curves in 2 to 3 hours, but the curve may then descend to near shock levels in the fourth, fifth, or sixth hour.

SUMMARY

There are three things that we in Flying Training Air Force have done which apparently have helped reduce our aircraft-accident rate. They are: (1) The initiation of the Physiological Near Accident Report in 1952. These near accident reports give far more information regarding accident causes than the fatal accidents reports, and could be used profitably in all Air Force training centers. (2) The education of our pilots regarding hyperventilation, which pointed out the symptoms and its dangers. (3) Our program for improving the eating habits of our student pilots.

There are many more questions that have to be answered about relative hypoglycemia and hyperventilation. It is believed that we have only scratched the surface. Our Flight Surgeons and our research laboratories are confronted with a definite challenge to obtain firm answers to these problems through the continued

co-ordination of clinical observations with fundamental investigation.

CONCLUSIONS

1. Two of the less obvious hazards for pilots in training are hyperventilation with hypocapnia and relative hypoglycemia.

2. The Flying Safety Program in the Flying Training Air Force has shown a decided decrease in the number of aircraft accidents and near accidents with the recognition and prevention of these hazards.

3. The future selection and evaluation of student pilots might well include the determination of their susceptibility to hyperventilation with hypocapnia and hypoglycemia.

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GENITOURINARY TUBERCULOSIS

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GENITOURINARY tuberculosis maintains a prominent position in the consideration of human tuberculosis because, in addition to the lungs, the genitourinary tract is one of the most frequent sites of clinically recognizable tuberculosis. The emphasis continues to be on pathogenesis and treatment. Evidence in the literature suggests that infection in the genitourinary tract is secondary to a focus elsewhere in the body. Usually this original focus is in the lungs, bone, or intestine.

Treatment is best considered in terms of the pre-streptomycin era and the post-streptomycin era. Before streptomycin sulfate (SM) was used in the management of tuberculosis, treatment was limited to surgical resection. At one time, it was believed that a diagnosis of unilateral renal tuberculosis should be considered concomitantly with immediate nephrectomy. The approach in the past was dependent upon diagnosing unilateral or localized disease and then performing radical surgery before the disease could become widespread and inoperable. Various radical surgical technics for genital and renal tuberculosis have been devised in an attempt to reduce the relapse rate and mortality after a 5-year period. Long-term studies varying from 3 to 14 years in both genital and renal tuberculosis have shown an over-all treatment failure of approximately 50 per cent following operation. These failures include both relapse and death. In isolated reports a 70 to 80 per cent conversion rate was attained with operation alone. However, the latter studies were usually of less than 5 years' duration. All long-term studies gave the patient a 50 per cent chance of relapse.[1]

The era of antituberculous drugs has relatively recently come into its own. It is hoped that in future years these drugs, added to judicious surgical intervention, will materially reduce the morbidity in genitourinary tuberculosis. The following discussion is a general review of the literature in an attempt to reiterate the present-day thinking concerning the pathogenesis and treatment of genitourinary tuberculosis.

INCIDENCE AND SITE OF DISEASE

The reported incidence of genitourinary tuberculosis in 15,000 documented cases of tuberculosis of all types was 4 per cent.[2]

From Valley Forge Army Hospital, Phoenixville, Pa.

The over-all ratio between males and females of tuberculosis of the urinary tract is approximately 3:1.[3] The predominant age group having genitourinary tuberculosis falls within the third to fifth decade; and the peak incidence occurs between the ages of 25 to 30 years, with a significant number of patients contracting the disease at age 50.[2]

There has been a considerable amount of data accumulated relating to the presence of extragenitourinary tuberculosis occurring concomitantly with genitourinary tuberculosis. As will be seen in the following discussion, renal tuberculosis always occurs secondarily to a focus of tuberculosis in some other organ.[4] However, there are times when no other evidence of tuberculosis can be discovered other than genitourinary tuberculosis. Varying reports have shown pulmonary tuberculosis to be detectable in 30, 50, and 70 per cent of cases.[4,5] Pulmonary tuberculosis was present in 62 to 73 per cent of patients having tuberculosis of the seminal vesicles, prostate, and epididymis.[5,6] Osseous tuberculosis is also relatively frequently associated with genitourinary tuberculosis. From 15 to 24 per cent of patients with genitourinary tuberculosis also have clinical evidence of skeletal tuberculosis.[6]

The question of unilateral or bilateral renal involvement has been debated much, and the terms "good" kidney and "unilateral" renal tuberculosis have entered the literature. This subject has been studied extensively by analyzing large numbers of autopsy cases. It is believed, from this type of data, that renal tuberculosis is initially bilateral. One may, however, find it necessary to make multiple serial sections of the kidney to demonstrate microscopic foci of tuberculosis. Some workers, in doing routine autopsies on patients who have died of pulmonary tuberculosis, with and without signs and symptoms of renal tuberculosis, have demonstrated 100 per cent bilateral renal involvement.[4] It is suggested that the term unilateral renal tuberculosis be used as a clinical expression and should really imply unilateral demonstrable tuberculosis. Not infrequently, microscopic foci in the opposite kidney may continue on to healing and scar formation and reach the inactive stage. On the other hand, the so-called "good" kidney may demonstrate evidence of tuberculosis within a few years following a nephrectomy.

If a patient has tuberculosis of the genital organs, the potentiality of the coexistence of urinary tuberculosis is great. Forty-five to 80 per cent of cases of renal tuberculosis are associated with genital tuberculosis.[4,6] Tuberculosis has been found in the prostate in 95.2 per cent of all patients having genital tuberculosis, and the epididymis has been involved in 48.5 per cent.[6] These data speak for themselves and em-

phasize that in all cases of genital tuberculosis in the male, the prostate is almost always involved, either alone or in combination with the epididymis and seminal vesicles.

Tuberculosis in the genital tract of the female is a much more difficult problem because the disease is less apparent. Most data on this subject are of an indirect nature but give some insight into the frequency of occurrence. Data have been variable in studying a large group of women who died of pulmonary tuberculosis. Autopsy material reveals that genital tuberculosis has been found in 1 to 30 per cent of these cases. In making a study of sterile women, it has also been indirectly found that 5 to 12 per cent of these women have evidence of endometrial tuberculosis.[7]

PATHOGENESIS AND PATHOLOGY[4-6,8]

Renal Tuberculosis. This is usually a secondary manifestation of tuberculosis elsewhere in the body. It is believed that a tuberculous focus of infection must first exist in an extrarenal site. This site is usually in the lungs; however, osseous tuberculosis may account for a focus of infection leading to subsequent hematogenous infection of the kidneys. In the English literature, tuberculosis of the intestinal tract is given significant importance in this respect. The kidneys are, thus, first infected by the hematogenous route. A bacillemia is produced by the discharge of bacilli into the circulation by erosion of the blood vessel at the site of the extrarenal focus. As a result of the very rich blood supply to the kidneys, these organs are most frequently involved following the bacillemia. The initial lesions are usually bilateral, in the cortex of the kidneys, and frequently occur in proximity to the glomeruli. These small initial cortical lesions may be completely healed by scar formation or become encysted. A small cortical lesion may ulcerate into one of the renal tubules and give rise to bacilluria. Under these circumstances, pyuria may not be present and the only evidence of renal tuberculosis may be the presence of acid-fast bacilli on culture of the urine. At this stage, urography will also be normal. The initial lesions in the cortex may be nodular or miliary, depending on the magnitude of seeding of the kidney from the distant foci. The caseocavitary type of lesion in the kidney is more important from the point of view of making a clinical diagnosis. These latter lesions frequently occur in the renal papillae as a result of spread from cortical lesions. The cortical foci spread either directly or via the hymphatics to the pyramids and give rise to definite lesions in the papillae where necrosis and cavity formation occur. The initial lesion in the renal papillae may consist of one or more tubercles. These tubercles coalesce and extend into the papillary ducts and caseation occurs. From this point, sloughing into the minor calyx eventually occurs and produces

bacilluria, pyuria, and hematuria. The hematuria may be microscopic or gross, depending on the size of the vessel eroded. There are several factors existing in the kidney which predispose to local spread within the tissue. Direct local spread and spread via the lymphatics have been mentioned. Tuberculous endarteritis or occlusion and thrombosis of an artery produced by the pressure of local tubercles may lead to a localized area of devitalized tissue in the kidney. Such devitalized tissue is a fertile area for the spread of tuberculosis. In addition, one of the papillary ducts may be occluded by the process and this would encourage a retrograde growth of the organisms behind the point of obstruction. If there is a considerable amount of vascular thrombosis involving the renal arterioles, the kidney may be converted to a small contracted fibrotic organ.

The tuberculous process, having invaded the minor calyx, will next extend to the adjacent major calyx and frequently convert the latter into a tuberculous cavity. The neck of the calyx may be closed and pyuria and bacilluria may no longer be present in the urine. The neck of the calyx may also be open intermittently, producing only periodically positive urine analyses. This process in the renal calices usually develops slowly. However, it may take several months or several years for a spread to the lower urinary tract to occur. Nevertheless, the pelvis of the kidney and the ureter are the next areas to be affected by the tuberculous process. In the renal pelvis, contraction and ulceration occur. This may cause extensive shrinking of the kidneys due to scar formations. Invasion of the pelvis and ureters occurs at first in the mucosa and then involves the submucosa and muscularis. The lesions in the ureters are usually small and result in abundant scar formation which may cause obstruction and further increase in the disease process above the area of obstruction. At times the ureter may be completely closed by stricture and produce what is known as autonephrectomy. This results in a small, contracted, fibrotic, nonfunctioning kidney containing tuberculous foci of infection.

Tuberculosis of the Bladder. During the course of renal tuberculosis, the urinary bladder sometimes becomes infected. There are several types of involvement in the bladder. Frequently, there are small yellow tubercles of a pale nature with a surrounding angry-red areola which occur most commonly about the ureteral orifices in the bladder, but are not necessarily always limited to these areas. The yellow tubercles may be absent from the bladder mucosa and the disease may present itself as a patchy red cystitis without tubercles. This is usually seen about the base of the bladder and sometimes on the anterior wall. Less frequently, there may be more extensive lesions of the bladder in which the whole thickness of the bladder wall is involved without the presence of visible tubercles. There is usually a

progressive ulceration. This type of lesion has been described in the literature as localized panmural tuberculous cystitis.[9] It is seen as a localized, granulomatous, fungating lesion involving the anterior wall of the bladder and usually about the size of a half dollar. This type of lesion tends to be more refractory to treatment. It is prone not to heal following nephrectomy as do other simpler lesions of a patchy or nodular nature involving the mucosa and submucosa. With panmural tuberculous involvement, the remaining bladder may look entirely normal and subtotal cystectomy appears to be the only successful means of curing this type of lesion.

Genital Tuberculosis. In the male, genital tuberculosis is thought always to occur secondary to urinary tuberculosis. Primary hematogenous tuberculous seeding of the genital organs in the male has theoretical possibilities but all indications strongly suggest that genital tuberculosis is most always secondary to urinary tuberculosis. The urinary tuberculosis may, however, as stated before, be in the form of asymptomatic renal disease manifested only by bacilluria with or without pyuria. As has been stated, over 95 per cent of patients with genital tuberculosis have involvement of the prostate.[6] The prostate may contain firm nodules or be enlarged with soft caseous foci. Following prostatic involvement from the urinary tract, the infection may be spread via the ejaculatory duct to the seminal vesicles and to the vas deferens. Involvement of the seminal vesicles and vasa may be in the nature of tubal thickening or a nodular type of beading. By extension of this same process the epididymis becomes involved. The most frequent site of involvement is the tail of the epididymis which may be enlarged and swollen. As the disease progresses, it may become soft and caseous and involve the entire testicle. The process may eventually extend to the scrotum, thus involving the whole area in a caseous mass which may rupture exteriorily forming a fistulous tract.

Genital tuberculosis in the female differs in pathogenesis and pathology, primarily because of anatomic differences. In the male, genital tuberculosis is believed to be a descending infection from an infection higher in the urinary tract, originating in the kidneys. Ascending infections from the lower urinary tract or genital organs to the kidney is believed to be unlikely in the male. Similarly, retrograde infection is not believed to occur in the female; that is, tuberculosis of the external genitalia is not likely to spread in a retrograde fashion to the pelvic organs. Conversely, urinary tuberculosis in the female is thought to be an unlikely cause of tuberculous involvement of the uterus, tubes, and ovaries. Female genital tuberculosis involving these organs is therefore a result of hematogenous dissemination. Genital tuberculosis in the female may also be secondary to generalized peritoneal and pelvic tuberculosis. This type of tuberculosis

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will not be considered in this discussion inasmuch as it is a complication of generalized tuberculosis of the pelvis and peritoneum. The fallopian tubes are most frequently involved first in the "seeding" from a distant focus of tuberculosis. Initial involvement of the tubes is sometimes indistinguishable from recurrent gonorrheal infection, even at the time of surgery. The tubal tissue involved is characterized by its pallor. There is a tendency to marked thickening and induration of the fallopian tubes; calcification is not infrequent. In approximately half of the cases, the fimbriated end of the tubes may be opened, and at the time of examination, caseous material may be expressed from the lumen. Within the mucosa of the tubes, there may be hyperplasia and thickening with tubercle formation and ulceration. From the tubes, the process is believed to extend in both directions to the uterus and to the ovaries. The uterus itself may rarely be involved initially. The chief involvement is in the endometrium. Tubercles are present but are usually small and difficult to recognize except at microscopic examination. The disease in the endometrium is characterized by ulcerations and caseous lesions. At times, miliary tubercles may be the chief lesions. When the ovaries are involved, tubal-ovarian abscess is seen which is not prone to spontaneous healing. The cervix is frequently spared but may be involved in approximately 5 per cent of cases of genital tuberculosis in the female. Cervical tuberculosis is usually associated with involvement of the tubes and uterus. It may have a papillary form presenting a cauliflowerlike growth which may grossly be indistinguishable from carcinoma. Tuberculosis of the external genitalia, the vulva and vagina, are the most infrequent sites in female genital tuberculosis. When it occurs, it resembles tuberculosis of the skin and there is a great tendency to papillary growth and ulceration, which may be related to the presence of more moisture in this area.

SYMPTOMS

Urinary tuberculosis may produce no symptoms. Pyuria and bacilluria may be the only indications of a lesion. When symptoms are present, urgency and frequency of urination resulting from tuberculous cystitis secondary to renal tuberculous is frequently noted. True renal colic may be encountered which is due to the passage of caseous material, blood clots, or bits of discharged calcified material into the ureter. A dull, constant, nagging flank pain over the affected kidney is a frequently described symptom which is thought to be secondary to hydronephrosis produced by ureteral stricture. The patient may occasionally complain of gross hematuria as a result of the tuberculous process eroding a medium-sized vessel. On rare occasions the picture of acute pyelonephritis or acute pyelitis may be produced, including acute pain, chills, and fever.[4,10]

Symptoms of genital tuberculosis in the male depend on the extent and location of the disease. In prostatic involvement, symptoms may be absent and discovery may depend entirely on physical examination. However, there may be dysuria or obstruction to the urinary flow by compression of the urethra or involvement of the urethra by the tuberculous process.[11] On rare occasions, stricture of the posterior urethra occurs, which can give rise to all the symptoms associated with benign prostatic hypertrophy and urinary retention. Symptoms of tuberculous involvement of the seminal vessels and the vas deferens may not be present. Involvement of the epididymis, however, may produce acute symptoms with pain and swelling, or there may be no symptoms whatsoever. The first indication of disease in the area may be the rupture of a caseous area through the scrotal skin causing discharge of caseous material following slight trauma.[5,6,12]

In female genital tuberculosis, symptoms have a tendency to be lacking. Any female, however, with symptoms of salpingitis who is virginal or who is free from venereal disease or postabortive infection should be strongly suspected of having genital tuberculosis. Amenorrhea may be present, but, of course, there are many other conditions that may produce this symptom.[7]

PHYSICAL SIGNS

In renal tuberculosis, physical signs are usually absent. The tuberculous kidney may not be palpable or tender.[4] Only on rare occasions may the kidney be enlarged to the extent that it may be palpable and slightly tender. Involvement of the prostate and seminal vesicles by tuberculosis may be manifested by swelling, tenderness, nodules, softening, or fluctuation. In the acute form of tuberculosis of the epididymis, there may be a tender swelling in the tail of the epididymis, usually with sparing of the testicle. The vasa may also be tender. There is not infrequently an associated hydrocele. As the process gets older there develops a firm, or soft, perhaps even fluctuant or "doughy," swelling in the tail of the epididymis. With long-standing disease of a more extensive nature, the testes may be involved in this swollen mass. Beadlike sclerosis may be present in the vasa. Involvement of the epididymis, vasa, or seminal vesicles on one side may also be associated with tuberculous infection on the contralateral side, even though this may be difficult to discover clinically.[5,6]

Diagnosis of pelvic tuberculosis in the female is extremely difficult without definite symptoms and palpable lesions. In most patients with palpable abnormalities in the pelvis, the diagnosis is made only after pathologic study.[7] It is frequently not suspected when there is no other evidence of tuberculosis in the body. Even in the presence of extragenital tuberculosis, palpable pelvic masses or abnormalities may lead to the suspicion

of genital tuberculosis, but its diagnosis will usually depend on laboratory data, operative specimens, or perhaps culdoscopy.

DIAGNOSTIC PROCEDURES

Routine urinalyses should be performed with particular attention to the presence of pyuria, hematuria, and albuminuria. The presence of pus cells in the urine is the most frequent abnormality. Hematuria is not infrequent and is usually microscopic. The occurrence of gross hematuria depends on the size of the vessel eroded by the tuberculous focus. Albuminuria is not usually seen until the disease becomes more advanced. A search for tubercle bacilli should be made on a stained smear of concentrated sediment, by culture, and guinea pig inoculation. It is to be remembered that the only laboratory finding of renal tuberculosis may be the presence of bacilluria. Pyelography, both excretory and retrograde, is one of the major procedures used in the clinical diagnosis of renal tuberculosis. There has been much discussion about the advantages of either method. Some authors state that the excretory pyelogram is usually not as completely satisfactory as the more complete filling obtained with the retrograde pyelogram. However, no dogmatic statement should be made and both methods should be utilized in each patient. An excretory pyelogram will give one an indication of the function of each kidney and may be followed by retrograde pyelography for a more complete study after a relatively good indication of the extent of the disease has been obtained. Lattimer and associates[10] classified renal tuberculosis into five main groups, according to the abnormalities seen on the pyelogram. They designate group 0 as renal tuberculosis manifested only by the presence of bacilli in the urine and with negative pyelographic findings. Grade 1 demonstrates only slight pyelographic abnormalities plus bacilluria. Grade 2 must have definite changes on the pyelogram consistent with tuberculosis involving one calyx plus bacilluria. Grade 3 has exactly the same criteria except that the pyelogram must show involvement of two calices. Grade 4 must show three or more calices involved on the pyelogram. Hydronephrosis, secondary to tuberculosis and specifically secondary to urethral stricture, is classified separately.

Cystoscopy should be performed in all cases of proven renal tuberculosis. Separate urine specimens should be taken from each ureter and from the bladder for microscopic examination and for a search for bacilli. In male genital tuberculosis, laboratory procedures are, for all practical purposes, limited to the examination of the urine for the presence of tubercle bacilli. Some authors advocate prostatic massage to collect samples for cultural studies. Others, however, believe that this process is unwise because of the possibility of dissemination of the

disease. On certain occasions a seminal vesiculogram may be performed.

In female genital tuberculosis, laboratory or diagnostic procedures are limited to three major steps. (1) Dilation of the cervix with curettage of the uterine endometrium may be performed in order to obtain a biopsy and material for culture. This material may also be used for guinea pig inoculation. (2) Menstrual blood may also be cultured. Some authors advocate this procedure as a routine in all female patients with pulmonary tuberculosis. The feasibility of such a wide-scale study, however, has its limitations. (3) Culdoscopy grants direct visualization and, under special circumstances, may lead one to suspect pelvic tuberculosis. Culdoscopy may be of particular importance in the follow-up study of patients with known pelvic tuberculosis following long-term adequate therapy.

THERAPY

Prior to the streptomycin sulfate (SM) era, therapy for genitorenal tuberculosis was limited to surgical intervention for all resectable lesions and conservative and sanatorium care for nonoperable lesions. For unilateral caseous tuberculosis of the kidney, nephrectomy was performed. For bilateral renal tuberculosis, conservative therapy was used and the prognosis was always poor. Even with nephrectomy for unilateral disease, there were only slightly more than 50 per cent of patients alive five years after nephrectomy. Genital tuberculosis, likewise, was treated by radical surgical resection when feasible. The introduction of SM and other allied drugs to the treatment of genitourinary tuberculosis added a new light and a new hope to this hithertofore unfavorable disease. Up until 1950, the use of SM was recognized as an excellent adjunct to genitourinary surgery [13] It limited the formation of fistulas following surgery, and permitted the use of localized resection rather than nephrectomy.[14-16]

Between 1950 and 1952, the response of genitourinary tuberculosis to many combinations of dosage of SM and para-aminosalicylic acid (PAS) given for periods of three to four months were studied.[7, 17-21] These studies indicated that minimal lesions all responded well initially, but that advanced lesions responded poorly. The recommendation at this time was to resect all lesions that were greater than minimal.

In 1952, Lattimer and his group[14] emphasized that 55 per cent or more of patients developed relapses within two years, when given short courses of SM and PAS, and proposed that treatment be continued for from one to three years. Minimal lesions were treated with drug therapy alone, but the tendency to treat all lesions other than minimal renal lesions with drugs plus surgery still remained.

Again in 1953, Lattimer and associates[10] summarized their experiences with chemotherapy of genitourinary tuberculosis. Cavities were persistently difficult to heal. Strictures in the ureter sometimes continued to cause difficulty after treatment and required dilation. Large lesions always responded the poorest, and in massive lesions no conversions were obtained. From these observations, Lattimer and associates concluded that any lesion large enough to be seen on a pyelogram was difficult to convert to a negative urine, and under these circumstances, surgery should be combined with chemotherapy. Experience still indicated that nodular lesions in the genital organs were prone to relapse and responded unsatisfactorily to drug therapy alone.

By 1953, Isoniazid (INH) had been begun on a limited trial basis. Lattimer and associates[2] found this drug effective in improving bladder ulcers and converting urine cultures to negative. The drug was particularly useful in SM-resistant cases. At this time, trials with triple drug therapy, INH, SM, and PAS, were instituted in an attempt to reduce the emergence of resistant organism by the use of three drugs which apparently have a different mode of action.

At the 14th and 15th Veterans Administration-Army-Navy Conference on the Chemotherapy of Tuberculosis in February 1955 and February 1956, Lattimer and associates[22,23] reviewed a large number of cases of genitourinary tuberculosis. Their work indicated that the best treatment results with the lowest relapse rate were obtained with the use of triple drug therapy (SM, INH, and PAS) and the continuation of this therapy for 24 months. Although Lattimer and associates had previously advocated surgical resection for all renal lesions greater than minimal, they indicated in 1956 that they were treating patients with moderately advanced and far-advanced renal tuberculosis without surgical resection. Some resected operative specimens observed by them indicated that more favorable results than previously suspected may be obtained from prolonged chemotherapy. Inasmuch as they are presently treating more patients with drugs alone, the next few years will afford an opportunity to compare the relapse rates in the present group as compared with the group of patients treated by them prior to 1955, when operative intervention was used on a more extensive basis.

The chemotherapy for genitourinary tuberculosis initially took a second place to the chemotherapy of pulmonary tuberculosis, in that the treatment of genitourinary tuberculosis was evolved about the experiences derived in the treatment of pulmonary tuberculosis. When one follows the evolution of drug therapy in this disease, it becomes quite confusing. An attempt

may be made, however, to summarize the present treatment of genitourinary tuberculosis. Surgical intervention should not be performed in genitourinary tuberculosis in the presence of active or unstabilized extrarenal tuberculosis. An effort should be made first to control and arrest the extragenital focus. The genitourinary tract should be re-evaluated then, in reference to the indications of therapy. By doing this, one will be able to derive knowledge by observing the response of the genital and extragenital focus under chemotherapy. In the absence of extragenital foci or in the presence of inactive extragenital foci, minimal lesions in the genitourinary tract may be treated with chemotherapy alone. Lesions other than minimal in nature have until recently seemed to require surgical intervention. However, there seems to be some indication that many moderately advanced and some far-advanced lesions may respond satisfactorily to long-term chemotherapy.

The present accepted drug regimen in genitourinary tuberculosis consists of 1 gram of SM every third day, 300 mg of INH daily, and 12 grams of PAS daily. Upon the recommendations of Doctor Lattimer, this therapy offers the best results to date when continued for at least 24 months. Patients with minimal renal lesions and normal findings on pyelography have had rapid clinical and bacteriologic reversal and have done well on only 1 year of this regimen. Recent reports[24] suggest that, in addition to PAS, INH in doses of 16 mg per kilo per day (with from 50 to 100 mg of pyridoxine), and SM daily for at least 3 months may further improve the chemotherapeutic results in tuberculosis.

SUMMARY

Genitourinary tuberculosis is a frequent extrapulmonary site of tuberculous infection. *Mycobacterium tuberculosis* may be disseminated via the blood stream from a primary extragenital focus and trapped by the richly vascular kidneys. Secondary foci of infection may then spread in a retrograde fashion to the genital organ. Tuberculous infection of the renal and genital organs of the female occurs by the hematogenous route.

Before and after the chemotherapeutic era and up to 1956, surgical resection was instrumental in all forms of treatment of genitourinary tuberculosis except minimal lesions. Present-day experience indicates that the pendulum may be swinging away from radical surgical excision. Two years of triple drug therapy (streptomycin sulfate, isoniazid, and para-aminosalicylic acid) without surgical intervention, are advocated for most genitourinary tuberculous lesions that show a response to therapy. Many patients with far-advanced lesions may do better than previously suspected on long-term drug therapy alone. Operative procedures should be reversed for those with the more advanced stages of the disease and based upon individual case circumstances.

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TUBERCULIN SENSITIVITY AMONG ARMY CHILDREN

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THE SUCCESS of the newer drugs and surgical methods in decreasing tuberculosis in the United States should bring new emphasis on the tuberculin skin test for detecting infections in children. Myers and associates[1] demonstrated that in Minnesota the incidence of positive reactors among school children has gradually declined from 70 per cent in 1916 to 4 per cent in 1956. This is typical of the trend throughout the country.

It was our impression that tuberculosis is more prevalent in dependent children of Army personnel than in the general population. To test the validity of this idea and elucidate the factors which might account for such a difference, a survey study employing the tuberculin skin test was carried out in the spring of 1956 at Fort Lewis, a typical Army post located in western Washington.

MATERIAL AND METHOD

In March 1956 a questionnaire requesting parental consent to tuberculin testing was given to 1,245 school children, aged 5 to 14 years, at the Fort Lewis and Dupont district schools. The children selected for study were all military dependents. One child who had been vaccinated with BCG was not included. A preliminary education program was presented at a Parent Teachers Association meeting with assistance from the Pierce County Tuberculosis Association, and was responsible in part for the excellent response. Only 39 declined the test. Many slips were not returned, and 49 agreed to the test but were either absent during the reading period or transferred before the program was in progress. A total of 1,041 dependent children of Army personnel were tested.

A short history was taken for each child, to determine any who had had known or suspected exposure to tuberculosis or

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had resided in a foreign country. For testing purposes intermediate strength tuberculin purified protein derivative was used. A quantity of 0.1 ml of PPD in solution containing 0.0002 mg of tuberculin was injected from a standard 1-ml calibrated tuberculin syringe through a 26-gage needle intradermally into the skin of the forearm. Two experienced Army medical technicians, under the direct supervision of an Army nurse, carried out all the inoculations. Results were read only once, 48 hours later, by one or the other of two medical officers. A reaction showing some induration, more than 5 mm and not exceeding 10 mm in diameter, was recorded as 1 plus. A 2 plus reaction was one measuring 10 to 20 mm in diameter, a 3 plus was one exceeding 20 mm in diameter, and a 4 plus reaction was recorded for severe induration and an area of necrosis. Doubtful cases were counted as negative.

Follow-up study was centered around a family conference after all subjects found to be positive and their parents had been screened with roentgenograms. Younger siblings were skin tested with 0.0002 mg tuberculin and examined roentgenographically if found positive. Army officers who had taken a recent yearly physical examination including roentgenograms of the chest were not re-examined (32 instances). Roentgenograms of the chest of 175 family contacts were made, and 52 additional skin tests were performed, 4 of the latter being positive. Only 2 children did not appear for some type of follow-up; in these cases there had been a change of station prior to the counseling program.

RESULTS

Out of the 1,041 tuberculin skin tests, 104 (10.0 per cent) were positive. Of these, 6 were 4 plus, 10 were 3 plus, 27 were 2 plus, and 61 were 1 plus. Table 1 shows the distribution of positive reactors according to grades in school.

Table 2 shows the results when the subjects are divided into two groups—those who had not been overseas and those who were native born in a foreign country or had been on foreign assignments with their parents.

In the overseas-assignment group there were 26 native-born Filipino, Puerto Rican, and Panamanian children who were positive. These subjects represent a special group, having recently come to the United States from areas with higher exposure rates. They constitute 25 per cent of the 104 found positive. From the questionnaire on foreign travel, it is estimated that 40 of the negative reactors also were native born in these three countries, although there were no personal interviews to substantiate this figure and it may be slightly high. Removing this biased group from the numbers listed in the "Overseas" line in table 2, results

in a per cent positive of 8.5 as compared with 7.3 for the "United States only" group (table 3). The slightly increased incidence of tuberculin sensitivity among American-born Army children who have lived in other countries is not significant and could well be due to chance alone or to inaccuracies in the biographical data submitted by the parents.

TABLE 1. *Results of tuberculin skin tests on 1,041 dependent children of Army personnel*

School grade	Number tested	Positive reactors		Negative reactors	
		Number	Per cent	Number	Per cent
Kindergarten	145	11	7.6	134	92.4
First	146	6	4.1	140	95.9
Second	176	13	7.4	163	92.6
Third	148	7	4.7	141	95.3
Fourth	107	10	9.3	97	90.7
Fifth	71	6	8.5	65	91.5
Sixth	78	14	17.9	64	82.1
Seventh	74	14	18.9	60	81.1
Eighth	54	9	16.7	45	83.3
Ninth	42	14	33.3	28	66.7
Total	1,041	104		937	

TABLE 2. *Results of tuberculin skin tests tabulated according to whether or not subjects had lived overseas**

	Positive reactors		Negative reactors		Total number
	Number	Per cent	Number	Per cent	
United States only	29	7.3	367	92.7	396
Overseas	75	11.6	570	88.4	645
Total	104		937		1,041

*Includes native-born children from Panama, Philippine Islands, and Puerto Rico.

The survey was responsible for the detection of 1 new case of active, moderately advanced, pulmonary tuberculosis in a parent. There were 6 instances of healed calcified foci in adults and children, and 1 case of presumably arrested, minimal, pulmonary tuberculosis in a child, age 9. In 4 children there was a clear-cut association with tuberculosis in a relative. In 2 cases

families living in Japan had discovered servants with pulmonary tuberculosis. Multiple positive reactors were found in 11 families, accounting for 25 cases. Twenty-one of the latter came from 9 families native to Panama, Puerto Rico, and the Philippine Islands. These 9 families contributed 20 per cent to the total group of sensitized children.

TABLE 3. *Results of tuberculin skin tests tabulated according to whether or not subjects had lived overseas**

	Positive reactors		Negative reactors		Total number
	Number	Per cent	Number	Per cent	
United States only	29	7.3	367	92.7	396
Overseas	49	8.5	530	91.5	579
Total	78		897		975

*Excludes native-born children from Panama, Philippine Islands, and Puerto Rico.

DISCUSSION

The declining rate of positive reactors in children seems to indicate that fewer children are being exposed to tuberculosis than formerly. Because of this it becomes even more important and productive to seek out those individuals who are tuberculin positive, not only to find active cases, but also so that this small group can be carefully observed throughout the years to come for earliest signs of reactivation. To emphasize the usefulness of early detection, Myers and associates stated, "Periodic examination at least annually will permit diagnosis of 95 per cent of evolving chronic pulmonary lesions while they are minimal, before they produce symptoms and usually before they are contagious." Furthermore, it is possible that drug therapy will be found of value in early treatment of recent converts, even though no evidence for progressive disease exists. This question is now being debated.[2,3]

Intradermal tuberculin testing on civilian school children has demonstrated varying rates of sensitivity depending on ages of subjects tested and locality in which the tests were done. In Kansas City the rate ranged from 1.3 to 3.1 per cent in kindergarten classes, depending on the sector of the city—the lower rates being in the better housing and higher income areas.[4] In New York City large numbers of high school children have been tested and show an exposure rate of from 5.7 per cent in the 13-year-old group to 19.4 per cent in the 17-year-old group.[5] This is considerably lower than the rates in our 11- to 14-year-old subjects.

In Pittsburgh the rate for 537 children, ages 1 to 15, consecutively hospitalized at the University of Pittsburgh and Children's Hospital during parts of 1950 and 1951, was 9.6 per cent.[6] Four rural Minnesota counties, testing during 1946 and 1947, demonstrated a low rate of 2.7 per cent in children of ages 6 through 14.[7] This group compares closely to ours in age spread, but in rate of tuberculin sensitivity is much lower than our rate of 10 per cent.

Certain types of information obtainable from studies such as this may be of value in answering questions regarding changing public health problems with tuberculosis. There is a need to know just what proportion of our school children are not being protected, what areas show the greatest exposure rates, and what is the cost involved in case finding through skin testing and mass chest surveying programs.

In a population of Army personnel and their families, which is largely prescreened by frequent physical examinations, the new case rate for tuberculosis would be expected to be low, as was true in our study. We have, however, demonstrated that dependent children who come to the United States as native-born Filipinos, Puerto Ricans, or Panamanians represent a group where the positive reactor rate is disproportionately high (26, or 39.4 per cent, of an estimated total of 66 subjects). This group, along with other previously infected children, represents a reservoir of possible focus of infection if the disease evolves into open lesion tuberculosis. Physicians concerned with the health of dependents should intensify their efforts to control tuberculosis through frequent use of skin testing programs with long-term follow-up and parent education regarding the need for periodic roentgenographic examination of the chest of previously infected children.

SUMMARY

One thousand and forty-one dependent school children of Army personnel stationed at Fort Lewis, Wash., were screened for tuberculin sensitivity by skin testing. The rate of positive reactors was 10.0 per cent, which is higher than in comparable civilian groups reported by others.

Of the children who had been overseas, 11.6 per cent had positive reactions as compared with 7.3 per cent for those who had lived only in the United States; however, 66 native-born children from Puerto Rico, Panama, and the Philippine Islands accounted for 25 per cent of the positive reactions.

The survey was responsible for the detection of one new case of pulmonary tuberculosis in a parent.

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TREATING TUBERCULOSIS IN A MILITARY HOSPITAL

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THE INTRODUCTION of specific drug therapy in tuberculosis brought a new era from which an effective plan of treatment is emerging. A review of the clinical records of a large tuberculosis service should reflect the pattern of management now evolving. With this in mind, the records of the tuberculosis section of this hospital for the past four years have been studied. Some of these data have been previously reported.[1,2] This material will be briefly presented along with comments as to the therapy trends. Further, some of the differences between military and civilian treatment of tuberculosis will be noted.

This hospital treats three different groups of patients: (1) military personnel (Army and Air Force), (2) dependents of military personnel, and (3) beneficiaries of the Veterans Administration. The military patients are largely young men with recent disease. The civilian dependents are mainly wives of servicemen, about a third of whom are foreign born. All stages of the disease are represented. The Veterans Administration patients are older individuals with predominately advanced, long-standing disease.

During 1955, 932 patients were discharged from the tuberculosis section. Of these, 15.2 per cent were found to be nontuberculous and 5.2 per cent had inactive tuberculosis, while 79.6 per cent were considered to have active disease. Of the patients with active tuberculosis, 89.9 per cent had pulmonary disease, 5.9 per cent had pleural effusion alone, and 4.2 per cent had extrapulmonary tuberculosis. In those with active pulmonary tuberculosis, the disease was minimal in 27.8 per cent and far advanced in 23.2 per cent, as compared with 18.5 per cent minimal and 30.1 per cent far advanced in 1952 (table 1).

The disposition of the patients is shown in table 2. Of the military patients, 46.8 per cent were transferred to Veterans

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Administration hospitals to continue treatment, while the remainder, with a few exceptions, were treated at this hospital until maximum results were obtained. Irregular discharges of

TABLE 1. *Distribution by type of disease of patients discharged from the tuberculosis section, 1952 and 1955*

Diagnosis	1952		1955	
	Number of patients	Per cent	Number of patients	Per cent
Total	1,423	100.0	932	100.0
No tuberculosis	239	16.8	142	15.2
Inactive tuberculosis	87	6.1	48	5.2
Active tuberculosis	1,097	77.1	742	79.6
Active tuberculosis	1,097	100.0	742	100.0
Pulmonary	946	86.2	667	89.9
Pleural effusion only	115	10.5	44	5.9
Extrapulmonary	36	3.3	31	4.2
Active pulmonary tuberculosis	946	100.0	677	100.0
Minimal	175	18.5	188	27.8
Moderately advanced	486	51.4	332	49.0
Far advanced	285	30.1	157	23.2

TABLE 2. *Disposition of patients with active tuberculosis, 1952 and 1955*

Type of disposition	Type of patient											
	Military				Veteran				Civilian dependent			
	1952		1955		1952		1955		1952		1955	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Total	620	100.0	415	100.0	327	100.0	147	100.0	150	100.0	228	100.0
Discharges with maximum hospital benefit	383	61.8	219	52.8	99	30.3	59	40.1	83	55.3	187	82.0
Irregular discharges	12	1.9	1	0.2	179	54.7	45	30.6	40	26.7	20	8.8
Deaths	5	0.8	1	0.2	28	8.6	13	8.9	2	1.3	3	1.3
Transfers to other hospitals, and administrative discharges	220	35.5	194	46.8	21	6.4	30	20.4	25	16.7	18	7.9

military patients (those in which the patient leaves against medical advice, with inadequately treated active disease) were in-

significant because of Army disciplinary powers. This is in sharp contrast to the Veterans Administration patients in this hospital, with an irregular discharge rate of 30.6 per cent, and to the average rate for irregular discharges of tuberculosis patients in Veterans Administration hospitals throughout the United States of about 40 per cent. The civilian dependent irregular discharge rate was 8.8 per cent, and those discharged with maximum hospital benefit reached 82.0 per cent as compared with 55.3 per cent in 1952.

TREATMENT

Hospitalization. The criterion for approved discharge is negative sputum, cavity closure, and roentgenographic stability for from four to six months. The time required to achieve this goal averaged 12 months for those with minimal disease; 15 months for those with moderately advanced disease; and 15 plus months for those with far advanced disease.

Available data for 1955 show a reduction in the period of hospitalization because of changes in policy. For example, military patients are now allowed to complete the last three to six months of their prescribed drug therapy while on convalescent leave, rather than remain under hospital supervision for this phase of the treatment. Nonmilitary patients are allowed to return home when conditions are suitable, once their sputum is negative for *Mycobacterium tuberculosis* and a noncavitary pulmonary lesion is stable in serial roentgenograms for at least three months.

The amount of physical activity allowed while awaiting stability of the disease is slowly being modified.[3] The trend has been toward less bed rest, but as yet there has been no radical change in policy. Of great interest is a project started at this hospital in July 1954.[4] It is a study designed to compare at random patients following the conventional rest program with patients on an in-hospital ambulant program. Patients in the latter group follow no rest periods and can be up and about the ward and grounds of their building at will. Thus far, no appreciable difference has been noted in the response of the two groups as measured by sputum conversion and roentgenographic evidence of clearing of the lung lesions, but morale of the ambulant group is much better. Further, this group is permitted to start educational and rehabilitation training shortly after admission.

Chemotherapy. The length of chemotherapy has been constantly increasing since the introduction of combined drug treatment.[5] All patients with active disease are given drugs for a minimum of 12 months whether the lesion is glandular, renal, pulmonary,

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or of bone. One of the following drug combinations is commonly employed: 300 to 450 mg of isoniazid (INH) daily with 12 grams of para-aminosalicylic acid (PAS) daily; INH and 2 grams of streptomycin sulfate (SM) every three days; or PAS and SM.

The simultaneous use of three drugs was found to have no advantage over dual therapy.[6] Ordinarily isoniazid, the most effective of the antituberculosis drugs, was included in the therapy of previously untreated patients. The use of isoniazid alone in early reinfection tuberculosis has been advocated by a few physicians, but no patients were placed on such a regimen. When treating primary tuberculosis in infants on the strength of only a positive tuberculin test, isoniazid alone was sometimes employed.

Isoniazid at conventional dosage rarely caused peripheral neuritis. With higher dosage it appeared in about 5 per cent of the patients. Pyridoxine hydrochloride is employed to prevent this complication. PAS is still a difficult drug to administer because of the gastro-intestinal irritation produced in some patients. The freshly prepared solution of sodium PAS is used. More acceptable preparations in stable powder form seem to be in the making. Eighth nerve toxicity from streptomycin with conventional dosage was an infrequent complication. Periodic audiograms are done on all patients, but vestibular studies are no longer routinely performed.

The re-treatment case with resistance to all three drugs is a difficult problem. The continued use of INH in such patients was favored despite the predominance of resistant strains. As a companion drug, viomycin sulfate was adequate. Pyrazinamide was used with caution, as its hepatotoxicity is still not a settled question. Oxytetracycline is a satisfactory short-term substitute for PAS and was employed occasionally.

How effective is drug therapy in converting the sputum? First it is to be noted that the per cent of patients treated to maximum hospital benefit (1955) who had a positive sputum sometime during their treatment was: military, 69 per cent; veterans, 52 per cent; and civilian dependents, 63 per cent. In a special study of 200 military patients treated to maximum hospital benefit (1953-1954), it was found that in the majority a positive sputum is converted in the first two months. After six or more months of treatment only 10 patients still had a positive sputum. It is of further interest that pulmonary operations were performed on 50 per cent of these same patients, *Myco. tuberculosis* was found in the surgical specimen in all except five.

Temporary Collapse. Artificial pneumothorax was abandoned at this hospital in 1952 and artificial pneumoperitoneum two years

later (fig. 1). Whether the infection is in the lung or other tissues, the response to drug therapy seemed much the same. The added benefits ascribed to lung collapse are not very convincing and would appear to be outweighed by the potential complications and inconvenience to the patients.

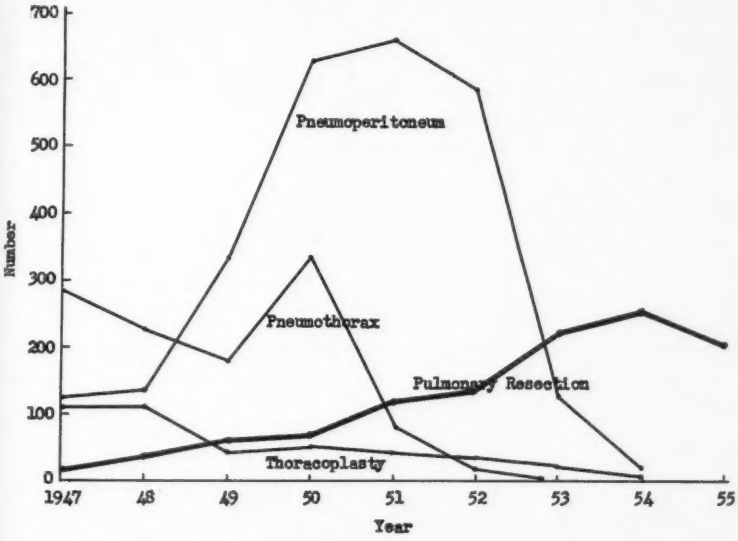

Figure 1. Trend in surgical procedures used in the treatment of patients with pulmonary tuberculosis, 1947-1955.

Surgery. Table 3 shows a 100 per cent increase in pulmonary resections between 1952 and 1954. In 1954, 51 per cent of the patients treated to the inactive stage of the disease had resections, largely segmental. The number and type of procedures performed are listed in table 4. Figure 1 indicates that the peak year for pulmonary resections was 1954. The decline since then has resulted largely from a decrease in segmental resections for small caseonodular residuals (under 2 cm in diameter) and for upper lobe segments that are contracted, fibrotic, and often bronchiectatic but without large nodular residuals. This changing attitude is prompted by the minimum activity often seen in the surgical specimens plus an increasing confidence in the adequacy of long-term drug therapy with isoniazid. Furthermore, while the mortality is low, the morbidity following resections has been sufficiently high to invite more conservatism. It is to be pointed out, however, that it appears likely that proportionately more resections will continue to be recommended for career soldiers than for civilian patients until follow-up studies have been com-

TABLE 3. *Patients treated to inactive stage who had chest surgery, 1952, 1954, and 1955*

Stage of disease	1952		1954		1955	
	Number	Per cent	Number	Per cent	Number	Per cent
Total	97	25.0	202	51.2	191	52.6
Minimal	24	18.8	51	44.0	58	20.3
Moderately advanced	55	21.9	109	56.5	117	56.7
Far advanced	18	34.6	42	53.2	16	41.0

TABLE 4. *Distribution of patients with pulmonary tuberculosis discharged in 1954 and 1955 who were operated on, by type of patient and operation*

Operation	Military		Veteran		Civilian dependent		Total	
	1954	1955	1954	1955	1954	1955	1954	1955
Total	104	111	47	10	85	70	236	191
Pneumonectomy	0	0	0	0	7	0	7	0
Lobectomy	25	17	15	2	21	16	61	35
Lobectomy and segmental or wedge resection	3	21	8	1	1	5	12	27
Segmental resection	48	39	11	2	36	28	95	69
Segmental with wedge resection	7	14	4	1	12	13	23	28
Wedge resection	12	5	1	0	4	0	17	5
Primary thoracoplasty	3	0	4	1	4	1	11	2
Lobectomy and plombage	0	2	0	0	0	0	0	2
Plombage	0	0	2	1	0	0	2	1
Pneumonectomy and plombage	0	0	0	0	0	1	0	1
Decortication	5	3	0	0	0	3	5	6
Decortication with lobectomy	0	0	0	0	0	1	0	1
Decortication with wedge resection	1	5	2	0	0	2	3	7
Decortication with segmental resection	0	5	0	1	0	0	0	6
Decortication, lobectomy, and segmental resection	0	0	0	1	0	0	0	1

pleted. This is because present figures suggest a lower reactivation rate for the resected patients.[7]

DEATHS

There were 17 deaths in 1955 or 2.2 per cent of the 790 tuberculous patients, as compared with 35 deaths in 1,184 tuberculous patients (3.0 per cent) in 1952. The various causes of death are detailed in table 5. No patient died of progressive tuberculosis. Most deaths resulted from pulmonary fibrosis, emphysema, or hemorrhage secondary to long-standing tuberculosis. For the second year there were no deaths caused by tuberculous meningitis.

TABLE 5. *Cause of death in patients with tuberculosis, 1952 and 1955*

Cause of death	1952		1955	
	Number	Per cent	Number	Per cent
Total	35	100.0	17	100.0
Surgical (total)	5	14.3	3	17.6
Operative	-	-	1	5.8
Early postoperative period	2	5.7	2	11.8
Late postoperative period	3	8.6	-	-
Medical (total)	30	85.7	14	82.3
Nontuberculous causes	8	22.8	5	29.4
Tuberculous (total)	22	62.9	9	52.9
Meningitis	4	11.4	-	-
Progressive or pneumonic tuberculosis	10	28.6	-	-
Pulmonary insufficiency	5	14.3	7	41.2
Massive hemorrhage	1	2.9	2	11.7
Silicotuberculosis	2	5.7	-	-

An evaluation of the success in treating veterans and civilian dependents is seen in table 6, which shows an appreciably higher percentage of successful results for both groups in 1955 than in 1952. The 1955 percentage of 87.6 for dependents versus 35.9 for veterans emphasizes the need for a stricter control of the Veterans Administration patient. The military tuberculosis hospital has an advantage in that the patient can be kept until his disease is inactive. However, such hospitals have a special responsibility to do everything possible to assure a low relapse

rate, because military life can be conducive to the ready spread of infection.

TABLE 6. *Results of treatment of veterans and civilian dependents with active tuberculosis, 1952 and 1955*

Result	Veteran				Civilian dependent			
	1952		1955		1952		1955	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Total	306	100.0	117	100.0	125	100.0	210	100.0
Successful (inactive stage)	81	26.5	42	35.9	77	61.6	184	87.6
Unsuccessful	225	73.5	75	64.1	48	38.4	26	12.4
Good chronic	18	5.8	17	14.5	6	4.8	3	1.4
Deaths	28	9.1	13	11.1	2	1.6	3	1.4
Irregular discharges	179	58.6	45	38.4	40	32.0	20	9.6

SUMMARY AND CONCLUSIONS

The length of hospitalization has been reduced for the military patient with tuberculosis, but it is still longer than that in civilian practice.

Only 50 per cent of the military patients treated for active tuberculosis are found to have a positive sputum. The majority of positive sputums convert in three months.

Dual drug therapy for a minimum of 12 months is favored. For primary treatment cases isoniazid is employed. As a companion drug para-aminosalicylic acid is probably superior to streptomycin sulfate.

Prolonged bed rest seems destined to play a minor role in the treatment program. The experience with in-hospital ambulant treatment has been very encouraging. With this trend a more aggressive in-hospital rehabilitation program is possible.

In 1954, 50 per cent of the military patients treated to maximum hospital benefits had pulmonary resections. Since then this percentage has been declining with fewer segmental resections being performed for minimal residuals. This decline appears to be due to an increasing confidence in drugs, particularly isoniazid.

Temporary collapse measures have been abandoned.

Treatment results of military patients are excellent because disciplinary powers result in practically all being treated to the inactive stage of the disease. Their relapse rate on follow-up after three-years of active duty is 3 per cent.

The program now in operation since 1951 has been successful. The serviceman contracting tuberculosis is no longer separated, pensioned for life, and his special skills lost to the Army. He is now returned to active duty, usually in less than two years, where assignments to fit his physical capabilities are provided.

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CINEPLASTY

Results of Follow-Up Study

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EUGENE E. BLECK, *M. D.*

CINEPLASTY has gained in popularity in recent years, but there are few follow-up studies available for its evaluation. The objective of this study was to determine whether or not the cineplasty was worthwhile to the patient. If it was not effective in providing a functional artificial arm, an attempt was made to discern the cause of failure.

Forty patients with known results from cineplasty comprise the basis of this report. These patients had cineplasty operations between 1946 and 1952. Of the 40 patients, 28 had biceps cineplasties and 12 had pectoral cineplasties.

SELECTION OF PATIENTS

All of the patients were young adult males between 20 and 35 years of age. The level of amputation varied. No biceps cineplasties were done on above-elbow amputations, and pectoralis cineplasties were not performed on long above-elbow amputations. Only the most co-operative and more intelligent patients were selected. The operation was explained in detail to these patients and they were informed regarding the advantages of the cineplasty. No attempt was made to force a patient's decision.

OPERATIVE TECHNIC

The operative technic followed was that described by various authors, differing only in several minor details.[1-4] All of the operations were performed under general anesthesia. The skin flap, raised for the muscle tunnel, measured at least 3 by 3 inches, and the base of the flap was made slightly wider than the sides and ends. After the biceps muscle was dissected completely from its bed, the insertion was severed. The muscle tunnel was made, with Mayo scissors, through the thickest and most central portion of the biceps muscle, and was made large enough to accommodate the index finger. It is important in biceps cine-

From Amputation Center, U. S. Naval Hospital, Oakland, Calif.

plasty that the tunnel be made perfectly straight, with its axis directly perpendicular to the long axis of the arm.

THE PROSTHESIS

Laminated plastic sockets were used in all patients.[5] The muscle tunnel pegs were made of soft dental acrylic molded over a stainless-steel core surrounded by a vinyl plastic tube. The pegs were either straight or "C" shaped (figs. 1 and 2).

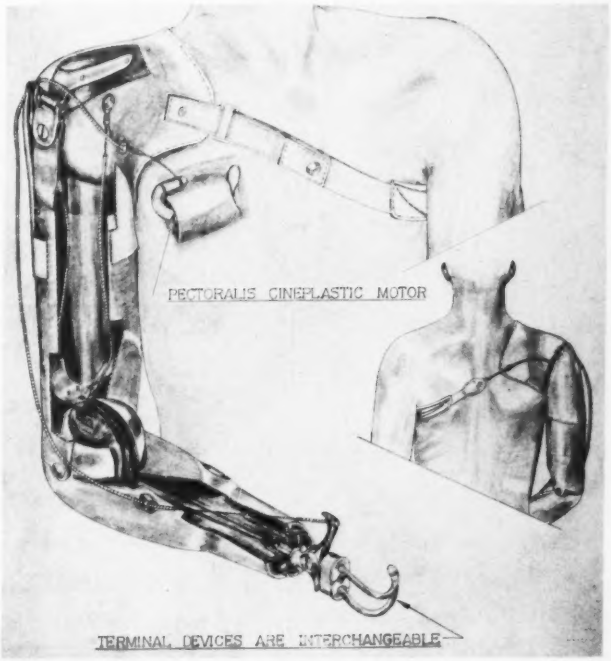

Figure 1. Cineplastic aluminum arm for shoulder disarticulation.

TRAINING IN THE USE OF THE PROSTHESIS

This final phase of treatment is the most important aspect in ensuring a good result from the operation. It first consists of postoperative exercises of the muscle motor. Those with biceps cineplasties were taught not to supinate the forearm when contracting the biceps muscle. The training in the use of the prosthesis was conducted by the occupational therapist and the amputee instructor. In addition to dexterity with the prosthesis, functional skills such as dressing, handling a screw driver, typewriting, et cetera, also were taught. Each patient had to pass an Achievement Test (fig. 3) before he could be discharged.

All patients were equipped with the Dorrance hook, Army Prosthetics Research Laboratory (APRL) hook, and APRL hand. The Achievement Test was given with each of these terminal devices.

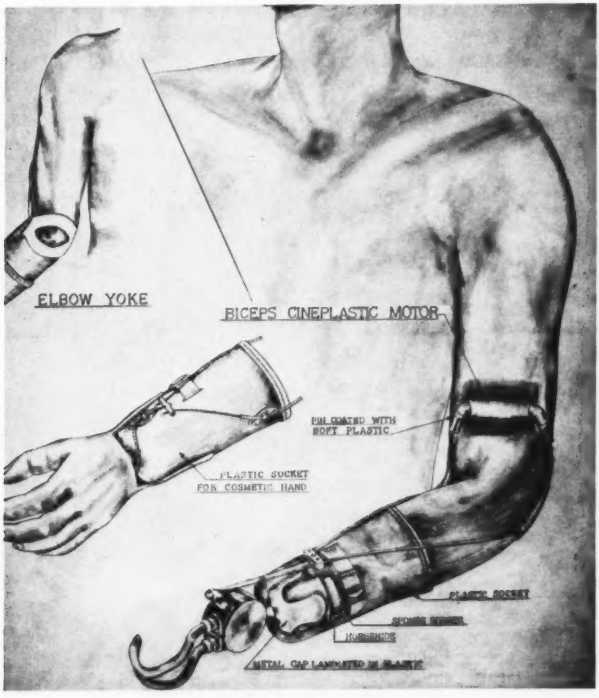

Figure 2. Cineplastic arm for wrist disarticulation.

METHOD OF EVALUATION

All patients were sent a standard questionnaire, devised by the U. S. Army Prosthetics Research Laboratory, Washington, D. C., for the purpose of analyzing the results of cineplasty. A questionnaire study was deemed valid in reaching conclusions. This gave the patients' reactions to the procedure. In addition an objective study, complete with examinations, was made of patients who resided in the San Francisco Bay Area.

RESULTS

Of the 40 patients questioned, 33 (82.5 per cent) were using their prostheses. Twenty-three (82.1 per cent) of these had biceps cineplasties and 10 (83.3 per cent) had pectoral cineplasties. Table 1 shows the effects of surgical complications on patients' decisions to use prostheses. Only 3 patients were

Name	Rate	Ward	Date
Amputation	Type Prosthesis	Terminal Device	
Date Training Started	Date Training Completed		

Dressing	Rating A	B	C	D
1. Put on shirt				
2. Operate pants zipper				
3. Button shirt cuff				
4. Don & adjust belt				
5. Lace & tie shoe				
6. Shine shoes				
7. Don & remove tie				
8. Wind, fasten wrist watch				
9. Clean glasses				
10. Don & remove glove				
11. Light match & cigarette				
Personal Hygiene				
12. Self care; toilet, shower				
13. Wash hands & face				
14. Using paste, brush teeth				
15. Shave, change blade				
16. Comb hair				
17. Clean & file nails				
Eating				
18. Carry full tray				
19. Use knife & fork				
20. Cut meat				
21. Butter bread				
22. Pick up cup & glass				
Daily Living				
23. Open & fold newspaper				
24. Open & close window				
25. Use door knobs				
26. Operate light switches				
27. Open & close drawers				
28. Open & close cabinets				
29. Open & close faucets				
30. Operate padlocks				
31. Sew on buttons				
32. Sweep; dustpan & brush				
33. Open capped bottle				
34. Use can opener				
35. Carry suitcase				
36. Take bills from wallet				
37. Pick up change, flat surface				
38. Wrap package with twine				
39. Fold, seal, mail letter				
40. Find phone no., hanging book				
41. Use coin phone				
42. Use dial phone, take message				

Poise	Rating A	B	C	D
43. Walk, swing arms rhythmically				
44. Shake hands				
45. Assist with chair				
46. Assist with coat				
47. Hang coat on hanger				
48. Proper sitting posture				
Vocational				
49. Sharpen pencil, knife				
50. Sharpen pencil, sharpener				
51. Rule paper in 1" squares				
52. Cut squares with scissors				
53. Fill fountain pen				
54. Use paper clip, thumb tacks				
55. Type 15 words per minute				
56. Assemble male wall plug				
57. Drive nails with hammer				
58. Use saw				
59. Use plane				
60. Use sanding block				
61. Use file				
62. Use hand drill				
63. Use calipers				
64. Use machinist's scale				
65. Woodworking				
66. Plastics				
67. Weaving				
68. Copper tooling				
69. Printing				
70. Ceramics				
71. Leatherworking				
Recreation				
72. Play checkers				
73. Shuffle cards				
74. Play card hand				
75. Dance				
76. Enter & leave car				
77. Enter & leave bus				
78. Operate car				
79. Raise hood				
80. Use jack				
81. Change tire				
82. Aquatics				
83. Volley ball				
84. Ping pong				
85. Skating				
86. Golf				

Rating Index
A: Excellent
B: Good
C: Satisfactory
D: Poor

Projects completed

Special Achievements

Minnesota Rate of Manipulation

	Number Trials	Score-Seconds	Percent Placement	Percent Population Surpassed
Hand				
Hook				

Signature With Hand	Signature with Prosthesis	Rehabilitation Specialist
		Therapist

Figure 3. The Achievement Test which each patient had to pass before he could be discharged.

unable to use their prostheses because of surgical complications. Patients who were using their cineplastic prostheses gave a variety of reasons for their preference for this type over the conventional type which they had worn previously and which could be used at any time (table 2). Of the 23 patients using their biceps cineplastic prostheses, 22 preferred this type to

a conventional one; of the 10 who were using pectoral cineplastic prostheses, 9 preferred them to the conventional type. Only one patient did not consider as worthwhile the extra time of hospitalization required for training in use of a cineplastic prosthesis.

TABLE 1. *Effects of surgical complications on patients' decisions to use prostheses*

Surgical complications	Prosthesis		Total (40) (per cent)
	Biceps (28) (per cent)	Pectoral (12) (per cent)	
Skin breakdown	21.4	16.6	20
Prohibited use	3.6	8.3	5
Incidental	17.8	8.3	15
Contracture of tunnel openings	7.0	-	5
Prohibited use	3.5	-	2.5
Incidental	3.5	-	2.5
Inadequate excursion	-	-	-

It should be noted that 6 patients had skin breakdown of the cineplastic tunnel, but this was not sufficient to eliminate permanently the use of the prosthesis. One patient had a contracture of the tunnel opening, but was still able to use his cineplastic prosthesis.

TABLE 2. *Patients' opinions as to advantages of cineplasty*

Reason	Biceps	Pectoral
Avoids shoulder shrug	23	9
Avoids shoulder harness	23	9
Better grip and control	22	8
Lighter and easier to use	21	7
More work in wider range	19	9
Sense of touch of normal arm	3	-
Independence of arms	2	2
Permits use of velocity elbow lock	-	Not used

Five patients with biceps and two with pectoral cineplasties were not using their cineplastic prostheses. Table 3 summarizes the reasons these patients gave for not using their prostheses. Poor co-operation of three patients is given as a reason for failure to use their prostheses. This again points out the importance of proper selection of patients for the operation. Five

TABLE 3. *Reasons patients gave for not using cineplastic prostheses*

Reason	Biceps	Pectoral
Extra time in hospital not considered worthwhile	4	1
Like shoulder control better	3	1
Poor co-operation	1	2
Painful stump or just uncomfortable	2	-
Intermittent skin breakdown	1	1
Contracture of tunnel openings	1	-
Breakdown of tunnel	1	-
Prosthesis lost or broken	1	-
Inadequate excursion	-	-
Does not require a prosthesis	-	-
Unsatisfactory in cold weather	-	-
Attributable to hospital management	-	-

of the seven patients who were not using their cineplastic prostheses were wearing conventional ones, and two were not wearing any prosthesis. Table 4 shows the level of amputation in these patients.

TABLE 4. *Use of conventional rather than cineplastic prosthesis in relation to the level of amputation*

Level of amputation	Using	Not using
Below elbow	4	1
Shoulder disarticulation	1	1

Use of the cineplastic prosthesis by patients in relation to the level of amputation is shown in table 5. The figures are inconclusive; deliberate selection of patients with long below-elbow stumps for biceps cineplasties produced the high per cent of good results in this group. Cineplasty is not recommended in forearm flexors and extensors because the tunnels have limited excursion and power. The use of biceps cineplasty in long above-elbow stumps is not desirable because shoulder harnessing is necessary in order to hold the socket on to the stump. Pectoral cineplasties were not particularly advised on long or medium above-elbow stumps inasmuch as it does not offer any great functional improvement and does not eliminate harnessing. Pectoral cineplasty for the very short above-elbow

stump or shoulder disarticulation is definitely indicated, since it does make a much more functional prosthesis.

TABLE 5. *Use of cineplastic prosthesis in relation to the level of amputation*

Level of amputation	Prosthesis			
	Biceps		Pectoral	
	Using	Not using	Using	Not using
Very short	2	1	9	2
Medium	10	3	1	-
Long	11	1	-	-

CONCLUSIONS

The good results (82.5 per cent) in patients who had cineplasties were higher than we anticipated and better than those reported by others.[6] In an attempt to analyze the reasons for the high per cent of good results, the following factors appear to be most important:

1. *The selection of patients.* This cannot be emphasized too strongly; intelligent and co-operative patients who desire the operation are a great asset.

2. *A modern and comfortable prosthesis.* In former years the prostheses were not successfully adapted to a cineplasty, and even though cineplasties were adequate surgically, failures resulted from poorly constructed and poorly functioning prostheses.

3. *Training in the use of the prosthesis.* This is the final, important phase of treatment and cannot be neglected. An occupational therapist with a fully co-ordinated program is essential.

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SIMPLIFIED METHOD OF PULP CAPPING ADULT TEETH WITH CALCIUM HYDROXIDE

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THE TECHNICS of pulp capping, pulpotomy, and pulp curettage have developed with little benefit of basic research or scientific study. A survey of the literature indicates that there is no preferred technic of pulp capping which is generally accepted and practiced by the dental profession.

The first report of pulp capping appeared in 1756, at which time Pfaff[1] recommended that gold foil be placed over the exposure. In 1826 Koecker[2] proposed that lead leaf be used after cautery with a red hot wire. Even as late as 1950, one typical textbook[3] recommended Pfaff's technic, but adds the use of the rubber dam along with sterilization and antibiotics.

Scientific studies have justified many of the procedures used in dental practice and frequently have resulted in their improvement; however, this is not the case in regard to pulp capping. If a vital pulp is exposed in an adult patient by caries or mechanically, a common procedure is either to undertake root canal therapy or to extract the tooth. This practice is encouraged by textbooks that discourage pulp capping except in select cases, and that insist upon time-consuming and almost impossible conditions of aseptic technic, temporary restorations, and use of multiple materials.

Many materials are described as acceptable, and the recommended technics of application vary widely. Among the most frequently recommended pulp-capping materials are zinc oxide and eugenol,[4] calcium hydroxide,[5-13] and thymol cement.[14, 15] These are either used alone or are applied in combination with other materials.

The first attempts to discover a scientific basis for the use of any specific technic or material were several independent

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studies for evaluating calcium hydroxide as a pulp-capping agent.[16-23] The number of cases involved in these studies varied from 6 to 45. The studies covered periods extending to 16 weeks, and presented both histologic and clinical evidence supporting the use of calcium hydroxide.

MATERIAL AND METHOD

The present study was undertaken to obtain clinical evidence as to whether pulp capping with calcium hydroxide is a simple and effective method of treatment that can be accomplished without time-consuming and complicated procedures. Whereas previous work has been largely limited to deciduous teeth, this study reports on adult teeth with no age limitation. Cases were selected at random from patients at Keesler Air Force Base, Miss., and Tachikawa East Air Force Base, Japan. The age of the patients varied from 17 to 46 years, averaging 27 years.

Teeth with pulp exposed by caries or by mechanical means were used, and since the ultimate desired result was the same; namely, preserving the vitality of as much remaining pulp as possible, pulp capping was not differentiated from pulp curettage or pulpotomy in cases where either operation was performed prior to the actual pulp-capping procedure. Pulp curettage and pulpotomy were treated merely as steps to be used, if necessary, in order to remove all caries prior to proceeding with the pulp cap.

Tooth location was not considered of importance in deciding on pulp capping. Reasonable accessibility was the only criterion, with posterior teeth being most frequently pulp-capped. One or more of the five surfaces of the coronal portion of the tooth was involved in each of the completed restorations. The number of pulp-capped teeth per patient ranged from one to three.

A few of the pulp-capped teeth were used as fixed bridge and partial denture abutments. In these instances permanent restorations were made, then at varying later dates the teeth were reprepared for prosthodontic abutment use.

A standard operating procedure was developed, with the exception that each of the eight operators chose his own moistening agent for calcium hydroxide and used it consistently. Sterile technic was not employed either in the oral cavity or in the exposed tooth cavity, nor were rubber dams, antibiotics, or temporary fillings used.

Preliminary roentgenograms were taken of each tooth, either before any operative work was undertaken or before the exposure was capped, and only teeth that had no apical involvement and had reached full adult apical development were used in this study. In every case all caries was removed, using normal, clean,

dental operating procedures. When the carious portion extended to the pulp, it was completely removed no matter how far into the pulp the operator had to go. If a pulp upon exposure showed any visible signs of infection, enough of it was removed to leave healthy bleeding pulp. Bleeding induced by the removal of caries was allowed to subside without interference.

The tooth cavity and mouth were then rinsed with tap water, and the cavity was air-dried as completely as possible. A thick layer of calcium hydroxide powder or paste was applied directly over the exposure. The calcium hydroxide cap was lightly air-dried so as not to disturb it, and completely sealed over with zinc phosphate base cement. Next, the cavity preparation was completed and a permanent restoration placed (fig. 1). Silver amalgam was the most frequently used permanent restorative

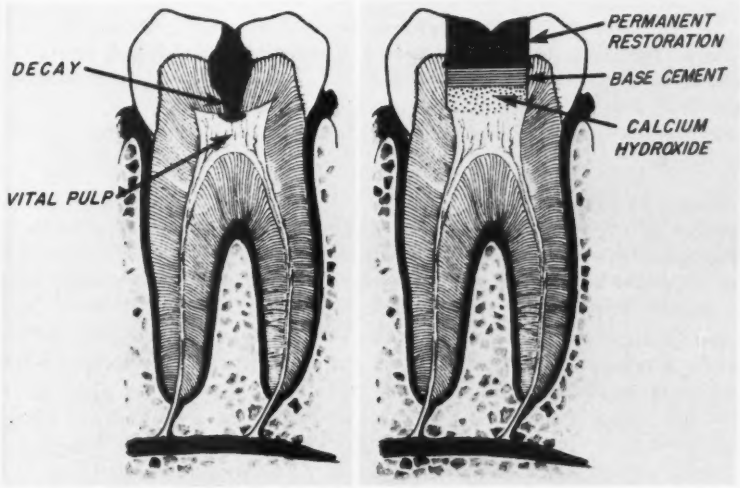

Figure 1. Pulp capping of adult tooth with calcium hydroxide.

material; however, a few of the teeth in this study were restored with gold crowns, silicate cement, or acrylic filling materials. The entire procedure, including a final roentgenogram, was completed in a single appointment and the patient dismissed, to report back at specified intervals.

The size of each pulp exposure was identified by its estimated diameter, or length and breadth, in millimeters. These sizes ranged from 0.5 mm to 4.0 mm, with an average of 2.0 mm. In every case there was a clinically vital pulp or pulp stump remaining to be capped.

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The moistening agent used in mixing the calcium hydroxide paste was tap water, sterile water, anesthesia solution, or zephirin chloride. The paste was mixed on a clean glass slab or paper pad and applied with a brush, cement instrument, amalgam carrier, or other suitable instrument.

Because of the roentgenographic characteristics of the restorative materials used, the obscuring locations, and the size of the restorations placed, most of the roentgenograms were of little use except as a check on apical conditions and periodontal membrane thickening. One operator used calcium hydroxide mixed with 25 per cent zinc oxide in an attempt to make the calcium hydroxide radiopaque. More than 25 teeth were pulp-capped with this mixture, but it was found that the radiopacity of the calcium hydroxide was only slightly improved. The zinc oxide-calcium hydroxide mixture gave the same clinical results as to tooth vitality as did calcium hydroxide alone.

Of the 304 teeth that were pulp-capped in the course of this study, the records of 140 were not available for final analysis because of personnel movements and the exigencies of military service. Five of the remaining 164 were extracted within 2 weeks, leaving 159 capped teeth that were carefully observed for a year or longer.

Each tooth was examined clinically at the end of 2, 6, and 12 weeks after being capped, if possible by the original operator. Records were consolidated by the authors and the teeth rechecked at 12 months (in 8 cases, also at 18 months). The examinations included roentgenograms, percussion, use of ice cones, and vitality tests with the S. S. White Vitalometer or its equal. Teeth were considered to be vital if they compared in vitality with adjacent untreated teeth.

RESULTS

The critical period for a pulp-capped tooth appeared to be the first 2 weeks. Seventeen of 164 teeth caused intermittent pain, and 5 of these were extracted within the first 2 weeks. Of the other 12, 6 had gradually become painless by the end of 6 weeks, and all pain had disappeared in the remaining 6 by the end of 12 weeks. Fifteen other teeth were sensitive, initially, to extremes of temperature. Only one of these was still sensitive at the end of 6 weeks, and it too had lost its sensitivity by the end of 12 weeks.

If pain or temperature sensitivity did not develop within 3 days, it did not develop during the entire period of observation. No drugs were used to reduce either pain or sensitivity. Obviously, sensitivity to extremes of temperature was not prognostic of

failure of a pulp-capping operation, nor was pain necessarily so, considering that of 17 teeth which caused pain, 12 became painless within 6 to 12 weeks and were still vital at the end of a year.

The type of moistening agent used in preparing the calcium hydroxide paste did not appear to have any bearing on the clinical outcome. The number of teeth that were symptomatic after pulp capping, including the 5 that were extracted in the first 2 weeks, were evenly distributed among the various operators.

Of 164 pulp-capped teeth, 5 (3.0 per cent) were extracted, but 159 (97.0 per cent) were vital and in good condition at the end of a year. The growth of secondary dentin was readily discernible in roentgenograms taken after approximately a year and a half (fig. 2). Throughout the age range of 17 to 47 years the results obtained were essentially equal.

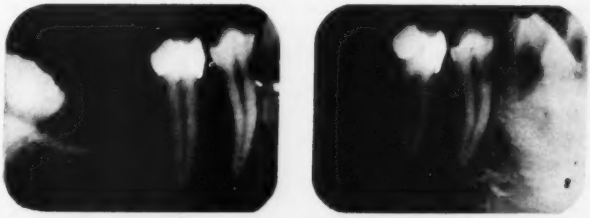

Figure 2. Roentgenograms of lower left second bicuspid tooth taken immediately after placing permanent restoration (left) and after 17 months (right), showing growth of secondary dentine.

Of special interest is the fact that 3 patients with pulp-capped teeth have flown at altitudes of 25,000 feet or higher without experiencing symptoms of any kind in the areas of the pulp caps.

SUMMARY

In the absence of a generally accepted pulp-capping technic and because of the complicated nature of the methods frequently advocated, exposure of a vital pulp often results in unnecessary root canal therapy or extraction of a tooth that could have been saved.

A simple method of pulp capping with calcium hydroxide without use of sterile technic, rubber dams, antibiotics, or temporary fillings was found to be clinically effective.

Of 164 teeth that were pulp-capped by this method, 5 (3.0 per cent) became painful and were extracted during the first 2 weeks,

while 159 (97.0 per cent) were vital and in excellent condition after a year or more.

Twelve of the 159 teeth that were saved by pulp capping caused some pain at first, and 15 others were initially sensitive to extremes of temperature, but in all cases both pain and sensitivity had completely disappeared by the end of 12 weeks.

ACKNOWLEDGMENT: We wish to thank the following for their assistance in the preparation of this article: Dr. Meyer Schwartz; Dr. Richard Mahler; Dr. William Pirsch; Dr. M. William Rose; Captain Richard Yokoyama, USAF (DC); and Captain William Gast, USAF (DC).

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SUBUNGUAL EXOSTOSIS

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THE PAIN and discomfort of foot disorders can have a deleterious effect on the mental attitude and physical condition of the man in service. At recruit training centers, the podiatrist sees great numbers of various foot disorders and can treat many of the more time-consuming and nonsurgical conditions, thus lightening the workload of the orthopedic surgeon. Close harmony can and should exist between podiatrist and surgeon.

Subungual exostosis is only one of the many, frequently seen disorders of the toes. Exostosis occurs elsewhere in the foot, but the subungual location is important, for it is easily overlooked and causes great discomfort. Lewin[1] described this condition as irritative, warty overgrowth of bone occurring beneath the nails in the form of solitary, benign, slowly growing, fibrous nodules the size of peas, which almost invariably are located on the inner or tibial margin of the terminal phalanx of a great toe. They arise as a cartilaginous outgrowth and become osseous. Their attachment to the phalanx is usually complete or osseous, but may be partial or fibrocartilaginous.

Pardo Castelló[2] stated that these lesions are not true tumors but outgrowths of normal bone tissue or calcified cartilaginous remains, varying in size from a few millimeters to two or more centimeters. Coming from the subjacent bone, they raise the whole nail or break through one of the sides or even through the plate itself, and the nail becomes distorted or is shed. Gross and associates[3] suggested that the condition is an inflammatory hyperplasia of bone, cancellous in character and growing upward after the osteogenic cells of the periosteum have been irritated.

The exact cause of the lesions is unknown. Most authorities agree that trauma plays an important part; if not the major factor, it certainly precipitates their growth. The possibility that subungual exostosis may represent a tetrologic anomaly has been suggested.[1] One theory[4] assumes that the growth is an attempt on the part of the terminal phalanx to form a double digit. Mason[5]

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stated that it is not improbable that some of these have been, in reality, supernumerary digits. Chronic infection about the nail bed is another possibility. Repeated minimal trauma over a period of years is sufficient to initiate this lesion. The great toe is the usual site, and this would appear to lend added significance to the trauma theory. It is generally agreed that the great toe is subjected to more trauma than are any of the lesser toes. Subungual exostosis is extremely rare on the hand, and most of the cases reported have involved the index finger.[5]

Granuloma pyogenicum, onychomycosis, ingrowing nail, fibroma, subungual verruca, cutaneous horn, melanoma, glomus tumor, and subungual heloma (corn) should be considered in the differential diagnosis. Roentgenographic examination is necessary to establish the diagnosis.

Very often this lesion may be present for years and remain undetected. Pain may be present, but frequently a lesion remains painless unless traumatized. The slight trauma produced by trimming the nail may be responsible for initiating symptoms. There is a tendency for the growth to increase in size, which in many cases influences the patient to seek medical advice.

The growth usually appears in patients who are from 12 to 30 years of age. A difference in incidence between the sexes is not established. The majority of those who do report a higher incidence in the female suggest that there is a relationship between the development of this lesion and the wearing of high heels.[6]

The treatment of choice, complete operative removal, can be accomplished by several methods depending on the location of the lesion. Special attention should be given to the nail bed and matrix during operation to prevent further nail-bed deformity and to preserve the integrity of the nail matrix. With careful surgical technic, the results are uniformly satisfactory.

CASE REPORTS

Case 1. A 19-year-old recruit complained of pain at the mediodistal end of the right great toe. The toe became progressively more painful during recruit training, and after 4 weeks of training he reported to the podiatry clinic for treatment. There was no definite history of previous trauma, although the patient thought that he might have injured the toe about three years prior to his recruit training. He stated that a nodule had been present at the end of the nail for at least two years and that it had grown considerably during this period. Six months after first noticing some deformity of the toe plate, he visited his family physician and was told he had a fungus infection of the nail. A proprietary drug was prescribed for daily use. No benefit was apparent after using the fungicide for three months.

Physical examination revealed a marked deformity of the nail bed and plate of the right great toe (fig. 1). The nail plate was elevated and deformed. The nail-bed deformity gave the appearance of a firm, fibrous, keratotic nodule breaking through and raising the nail plate at its most distal and medial part. The nail plate showed evidence of mycotic involvement.

Figure 1 (case 1). Close-up of right toe, illustrating the nail-bed deformity.

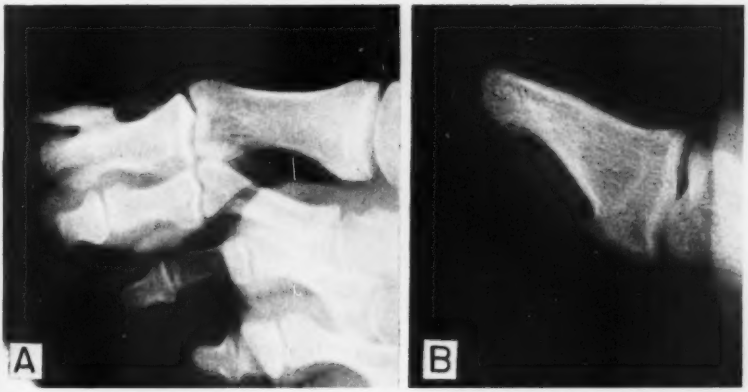

Figure 2 (case 1). (A) *"Table-top" exostosis, as seen in roentgenogram, projecting from the superior surface of the distal phalanx.* (B) *Postoperatively, the distal phalanx is normal in appearance.*

Roentgenograms revealed a large exostosis of the "table-top" variety, projecting upward and proximally and coming off the superior surface of the distal phalanx of the right great toe. The exostosis was consistent with the nail-bed deformity (fig. 2A).

Treatment consisted of palliative measures until the completion of recruit training, at which time he was admitted to the orthopedic service of this hospital for surgical removal of the growth. Figure 2B illustrates the postoperative roentgenogram.

Case 2. A 19-year-old recruit complained of pain at the mediodistal aspect of the left great toe which started after one week of recruit training. The patient stated that "the toenail has looked funny for the last two years." Because the toe was not painful, he paid little attention to it. About eight months prior to entering the service, a two-by-four piece of lumber fell on his left great toe. The toe was swollen and discolored but he did not receive medical attention. One week after the injury he lost the nail plate.

Deformity of both the nail plate and bed was seen on examination. The mediodistal portion of the nail was elevated and the lesion appeared as a firm pink nodule (fig. 3A). Roentgenograms revealed a large subungual exostosis of the "table-top" variety (fig. 3B).

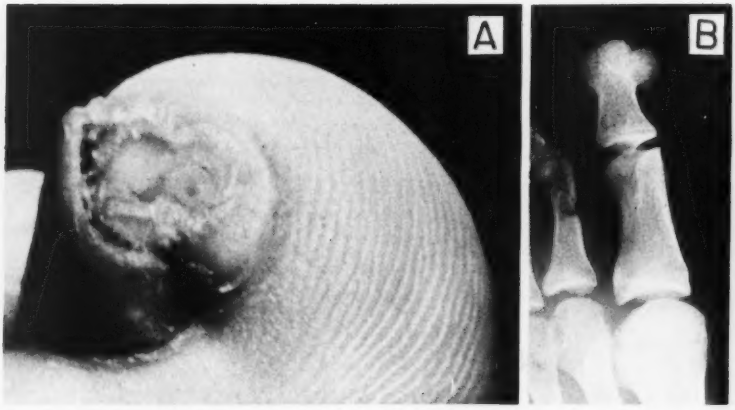

Figure 3 (case 2). (A) *The nail plate is elevated by the nail-bed deformity.* (B) *Roentgenogram demonstrates a large subungual exostosis projecting from the superior surface of the distal phalanx.*

Unfortunately, roentgenograms were not taken at the time of initial injury. If so, a more definite conclusion could be drawn as to the part trauma played in this case. Inasmuch as the patient had noticed a deformity of the nail plate before the injury, the exostosis was probably already present. Whether the trauma aggravated the lesion or precipi-

tated an increase in growth is a matter of conjecture. The exostosis was removed and the patient had no further difficulty with the toe.

Case 3. A 40-year-old nurse complained of a chronically painful left great toe. For two years she had noticed a small, pink, pealike growth just under the nail plate at the lateral distal aspect of the left great toe. There was no history of trauma; however, for three or four years she had had an ingrowing toenail. As a result of this, she developed a chronic nail infection. The pain was minimal, and by wearing wide-toed shoes she remained fairly comfortable. She had never sought medical advice concerning this lesion but came to the podiatry clinic because of worry over an increase in its size.

Physical examination revealed a small, pink, pealike lesion protruding from under the lateral distal aspect of the left great toenail. The nail plate was slightly elevated in this area; otherwise it appeared normal (fig. 4). There was a considerable amount of subungual debris present. Roentgenograms revealed a small "table-top" exostosis lying over and attached to the superior portion of the distal phalanx (fig. 5A).

Figure 4 (case 3). The lesion protruding from under the lateral distal aspect of the left great nail plate.

Treatment consisted of surgical removal. Figure 5B shows the specimen after operation; because of the radiolucent cartilaginous elements present, it is much larger than it appeared in the preoperative roentgenogram.

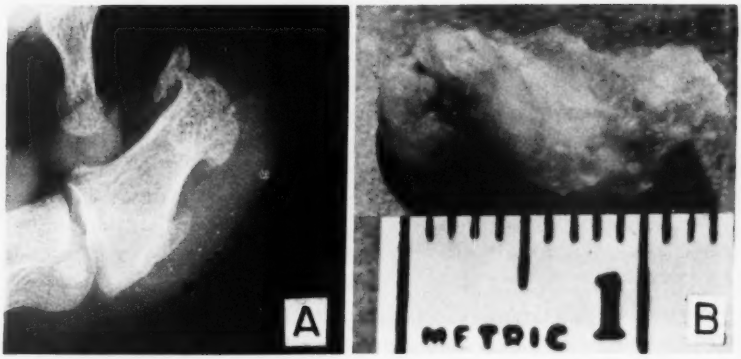

Figure 5 (case 3). (A) *Roentgenogram shows exostosis projecting from distal phalanx of left great toe.* (B) *Lesion removed at operation illustrating the discrepancy between actual size of lesion and size of visible portion seen on the roentgenogram.*

SUMMARY AND CONCLUSIONS

Subungual exostosis usually occurs on the great toe. Although the cause has not been fully established, trauma definitely plays an important part. Pain may be severe, mild, or absent. Growth of this lesion may be progressive, and often causes the patient to seek medical attention. Such bone growth may exist in any case of nail-bed and nail-plate deformity and emphasizes the importance of roentgenographic examination. A lateral view plainly demonstrates the growth.

In differential diagnosis, subungual exostosis is confused most frequently with onychomycosis, which often is associated with the exostosis as described in one of the case reports.

Complete operative removal of the exostosis, with care not to injure the nail bed or matrix, is the treatment of choice and consistently produces satisfactory results.

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SIMPLIFIED MICRORADIOGRAPHY OF BONE AND TEETH

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A TECHNIC has been developed for the microradiographic study of mineralized tissues using relatively inexpensive radiographic equipment. This technic makes the procedure available to the laboratory, hospital, or teaching institution with a limited research budget. The advantages of investigating biological structures with roentgenologic microscopy were reviewed by Engström, Bellman, and Engfeldt.[1]

Our method is a simplified version of the technics described by Lamarque,[2] Engström,[3-5] Amprino and Engström,[6] Engfeldt and Zetterstrom,[7] and Vincent,[8] and as such may serve to entice more investigators into this field of study. The technics described by the above investigators require the use of relatively expensive beryllium window roentgen ray tubes, and generally, vacuum type systems, whereas our technic employs the cheaper nickel window tube, and omits use of a vacuum system.

The unit we use is a grenz ray (soft roentgen ray) generator manufactured by the Ullman Corporation (fig. 1). This is a small, compact unit, adaptable for use in limited spaces. It consists of a self-rectified generator with current range of 0-5 ma and voltage range of 0-30 kvp, plus a tube with tungsten target. Inherent filtration is 0.0008 inch of nickel. The unit is designed for continuous operation, and the heat produced by long exposures has little effect on the microradiograph. It has been noted that if a brief cooling period is allowed between exposures, the current output is more stable. Extra stabilizers can be employed to regulate the incoming current if a continuous fluctuation is noted. This usually is caused by intermittent loads on the power line.

Fresh or fixed bones or teeth are cleansed of soft tissue and cut into sections 50 to 100 microns in thickness (fig. 2) on the Scott and Crisp Tooth Sectioner.* Sections selected for micro-

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radiography are hand-lapped to a final thickness of approximately 30 microns. When the desired thickness has been obtained, the specimens are washed in absolute ethyl alcohol and dried for one hour. Satisfactory results are obtained with sections varying between 30 and 100 microns. Sections thinner than 30 microns have been used, but unless a specially designed supporting holder is employed, distortion and poor detail result. Distortion always occurs when the specimen is not in uniform contact with the emulsion of the film.

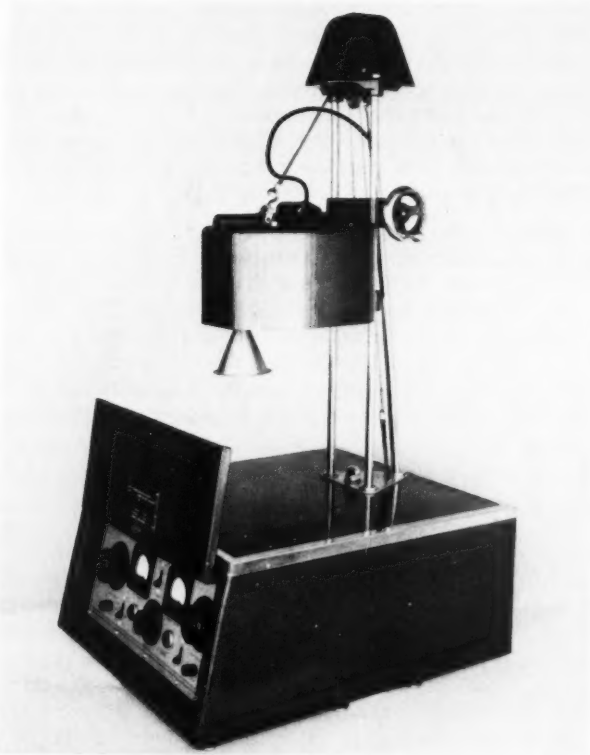

Figure 1. Soft roentgen ray apparatus used for microradiography.

With the availability of many fine-grain, high-resolution spectroscopic plates, such as Eastman Kodak 548 and 649 (500 to 1,000 lines per mm), fine detail can be obtained. The "GH" type emulsion is used, instead of the lower sensitivity "O" type emulsion.

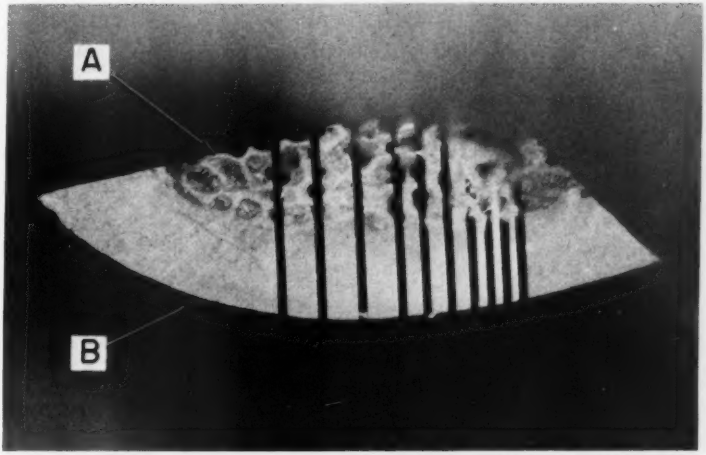

Figure 2. Serial sectioning of mineralized bone. Serial sections are made transversely and longitudinally of varying thickness, so as to include the endosteum side (A) *and periosteal side* (B). *The maximum thickness that should be used is about 100 microns.*

The dried specimen is placed in direct contact with the emulsion and covered with sheet aluminum 0.001 inch thick. The aluminum serves not only as a slight filter, but also as a light-tight cover (fig. 3). The covered packet is backed with

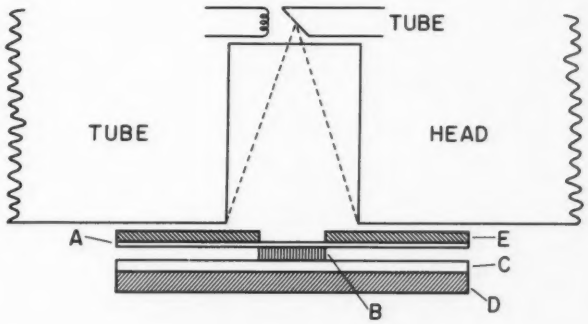

Figure 3. Diagram of specimen holder. A. *Aluminum 0.001 inch.* B. *Specimen 30-100 microns.* C. *Spectroscopic plate.* D. *Lead 0.125 inch.* E. *Aluminum compression disk.*

0.125 inches of lead, then placed in the roentgen ray beam 4 cm from the target. This short distance was selected in order to decrease exposure time. The low milliampere output of the small roentgen ray generator used prohibits longer target-film distance. A longer target-film distance would be preferable, but with proper centering of the specimen, good results are obtained with the shorter distance.

The average exposure technic for samples of mineralized bone, ground to 30 microns, is 12 kvp and 4.5 ma for 35 minutes. For specimens thicker than 30 microns, an increase in kilovoltage and exposure time is required. The exposure time may be increased to as much as 60 minutes for bone sections of 75 microns in thickness. An exposure of 50 minutes at 20 kvp and 2.5 ma produces satisfactory results with tooth sections of 100 microns in thickness.

Spectroscopic plates are processed in Eastman Kodak D-19 developer for 7 minutes at 68° F, with slight agitation each minute during development. The plate is then rinsed in alcohol for 30 seconds with continuous agitation, washed in running water, and placed in a standard acid fixer for 30 minutes. After washing for 30 minutes in running water, processing is completed by drying the film in a dust-free atmosphere. If a brown stain appears on the plate, most of it can be removed after the plate has been processed and washed, by bathing the plate for 3 to 5 minutes in 95 per cent ethyl alcohol.

The finished radiograph is covered with a standard coverglass and examined under a microscope. Standard photomicrographic technics are used for recording fields of interest. Photomicrographs ranging from 50 to 250 diameter magnification can be obtained.

Figure 4 shows the uneven distribution of the mineral salts in normal human femoral bone. The Haversian systems (osteons) differ among themselves as well as from the surrounding tissue in degree of mineralization. The organic nature of the osteocyte and its capsule are relatively transparent to roentgen rays and thus appear as round or oval dark spots.

In their study of heterologous bone grafting, Hurley and Losee[9,10] took microradiographs of bone sectioned through the implant site at various periods after operation. Figures 5 and 6 show the mineral bonding between anorganic donor bone chips and host bone in a six weeks postoperative specimen, and leave no doubt as to the biological acceptance of the graft material.

Figure 7, a longitudinal section of human cortical femoral bone, illustrates the complexity of the systems of Haversian and Volkmann's canals, which must be considered in evaluating

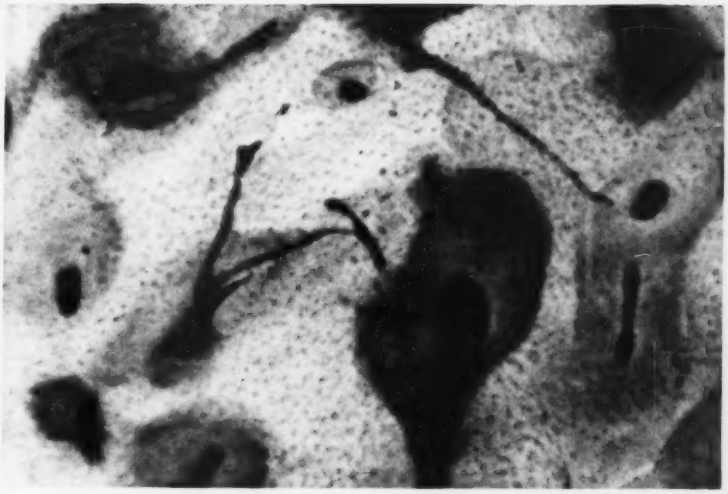

Figure 4. Microradiograph of cross section of human femoral cortical bone from a normal 37-year-old male. The varying mineral distribution is readily seen when osteons are compared. The interstitial bone in general appears as more mineralized; the lacunae of the osteocytes appear as black spots. A large Volkmann's canal is entering from the endosteal side into a poorly mineralized osteon. Other Volkmann's canals are visible. (× 150)

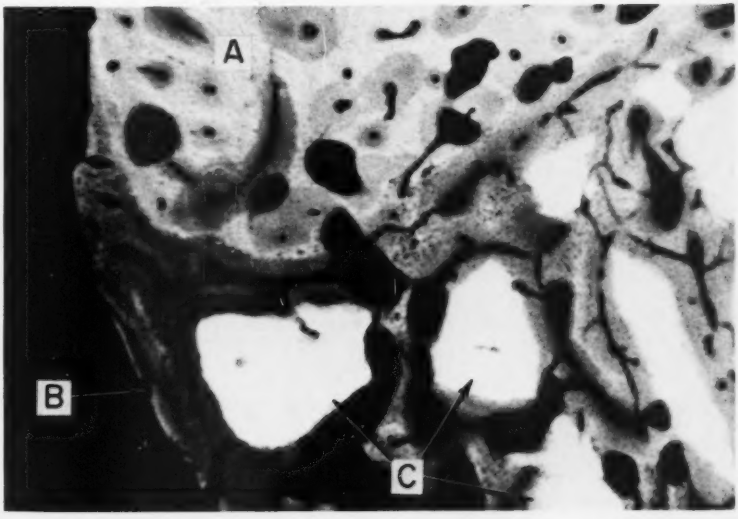

Figure 5. Microradiograph of six-week-old anorganic bone implant. Donor bone (A) *shows the quantitative distribution of mineral salts in the various osteons. Cortical defect* (B) *is filled with mineralized callus and anorganic bone chips* (C). *(× 32)*

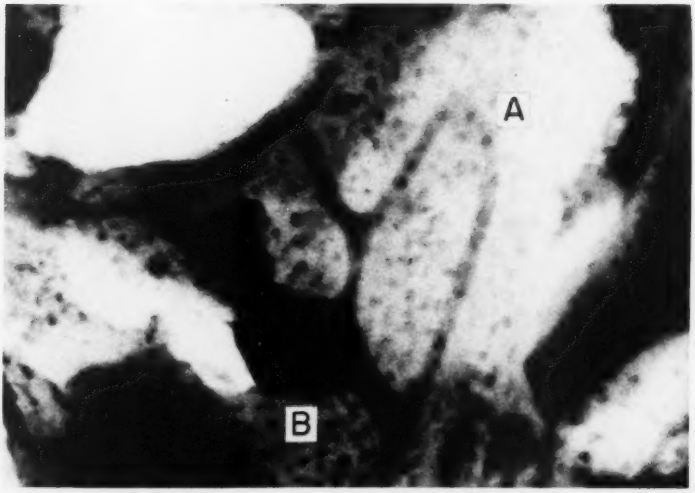

Figure 6. Higher power microradiograph of implanted anorganic bone chips. Mineral bonding is apparent between donor chip (A) *and host callus* (B). *Multiple black dotted areas are lacunae which permit easy passage of roentgen rays.* (× 200)

Figure 7. Microradiograph of a longitudinal section from same human cortical bone used in figure 4. Complexity of the canalicular system of cortical bone is apparent. Volkmann's canals are quite numerous and do not appear to have a uniform pattern. (× 100)

microradiographs. On the enamel side of the dentino-enamel junction near the tip of the dentinal cusp, the spindles become visible because of their organic composition. A region of lower mineral content is represented by the increased radiolucency. In figure 8 the hypocalcified tufts or whorls are seen as wavy black bands in the inner enamel running at right angles to the dentino-enamel junction.

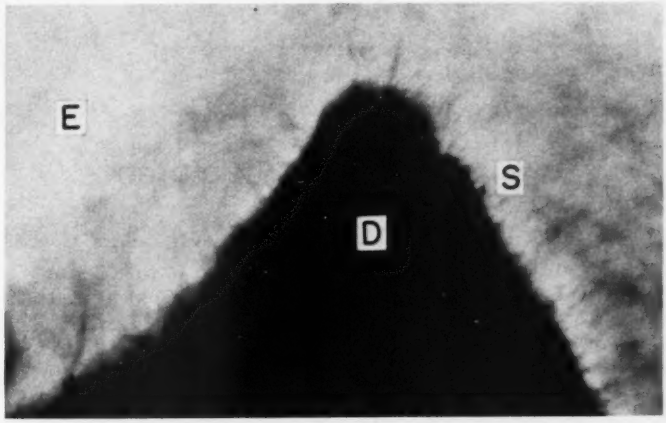

Figure 8. Enamel spindles (S) *and dense organic matrix area are visible at the tip of the dentinal cusp* (D) *in the enamel* (E).

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Clinicopathologic Conference

Valley Forge Army Hospital, Phoenixville, Pa.*

RECURRENT COMA

Summary of Clinical History. A 20-year-old white man was admitted to this hospital in a semicomatose state. No medical history was immediately available. His friends indicated that he had been out the night before but had not been drinking heavily. On the morning of admission he had gone to work but had not felt well. Later in the day he had returned to his room to rest, and at about 1400 hours had been found by friends holding his head as if in pain and mumbling incoherently. During the next day he gradually became more rational, and a medical history was obtained except for the events of the preceding two days, for which the patient had a complete amnesia. Past medical history was noncontributory. During the preceding year, he had become interested in hypnotism and had practiced it with his friends. He had been known to make bizarre statements concerning previous existences; for example, he claimed to have existed in Rome in the year 1 B. C. as a sewer rat.

Physical Examination. On admission, the patient was stuporous and responded sluggishly. Pulse was 44/min and irregular; temperature, 98°F; blood pressure, 110/80 mm Hg; and respirations, 12/min. No evidence of trauma was found. The pupils were round and regular and reacted to light. A pigmented chorioretinitis was seen bilaterally. Neurologic examination was negative.

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*Brig. Gen. Sam F. Seeley, MC, USA, Commanding General. From the Pathology Service, Capt. Dale M. Schulz, MC, USAR, Chief.

Laboratory Studies. An electrocardiogram showed sinus bradycardia and sinus arrhythmia. Roentgenograms of the chest and skull were negative. Laboratory findings on admission were within normal limits. Tests for barbiturates and bromides were negative. There was a faint positive reaction for salicylate in the urine specimen. Blood alcohol was below the level of significance.

Course in Hospital. A spinal puncture revealed an initial pressure of 290 mm of water. Queckenstedt's test was not done. The patient was restless and had to be restrained during the procedure. He responded to painful stimuli but did not become lucid until the day after admission. On the third hospital day he had a mild recurrence of symptoms. He continued to complain of headaches and was transferred to the neuropsychiatric department. A repeat lumbar puncture showed an initial pressure of 600 mm of water. The spinal fluid was clear with 12 cells (2 polymorphonuclear leukocytes and 10 lymphocytes); total protein, 22 mg/100 ml; and sugar, 54 mg/100 ml.

The patient complained of difficulty in focusing his eyes and stated that his headaches had begun with a recent fainting spell. He was not vomiting and did not complain of nausea. On the ninth hospital day he again became comatose, and neurologic examination again failed to reveal any abnormality. During the next week he continued to improve, although his gait was still unsteady. Another lumbar puncture, done while the patient was sedated with Amytal Sodium (brand of amobarbital sodium) showed an initial pressure of 160 mm of water. On the 22d hospital day he was found dead in the bathroom.

DISCUSSION

Doctor Bealer:* From the data given in the protocol, it would seem that the symptoms must represent increased intracranial pressure, and the question is to determine the exact cause. The symptoms on admission and those present throughout the hospital course are of a general nature, *i. e.*, confusion, amnesia, headache, syncope, and coma. As an aid in localizing the lesion only the ataxia, visual blurring, irregular bradycardia, and slow respiratory rate maybe of significance, and it must be remembered that these may also only represent generalized increased pressure.

In arriving at a tentative diagnosis, it might be well first to rule out some of the common causes of such a clinical picture in males in this age group. The first thing that comes to mind is the possibility of trauma and a subacute or chronic subdural hematoma. The history is obviously open to much question, and such an injury could well have been sustained; however, the normal roentgenograms of the skull, the absence of signs of trauma, the absence of blood in the spinal

*1st Lt. Louis A. Bealer, MC, USA, Intern.

fluid, and the normal neurologic findings with no signs of meningeal irritation make this an unlikely diagnosis. Second, one might think of some infectious process, but opposed to this possibility are the normal spinal fluid, normal routine laboratory findings (in particular the leukocyte and differential counts), the afebrile course, and the absence of any foci of infection such as the middle ear, sinus, or lung. Third, I think that the findings of the toxicologic studies plus the routine laboratory work make unlikely such entities as diabetes, renal disease, drug intoxication, et cetera.

I believe that the two most likely possibilities are brain tumor and hemorrhage, the latter probably from an aneurysm. In support of the diagnosis of neoplasm, certainly all of the signs of generalized increased intracranial pressure present here would be expected. An increase in the cerebrospinal fluid protein is common, as are increased cell counts, particularly the mononuclear cells, but this does not always occur. The most common single sign in such cases is papilledema which was absent throughout this patient's course. However, papilledema is not seen in about 15 per cent of cases, particularly if the tumor is of such proximity to the optic foramina as to occlude them. One would expect signs of early optic nerve atrophy, however, if such were the case. If one were to speculate on the location of the neoplasm, the two most striking findings would be the bradycardia with irregularity and the slow respirations. On this basis, one might assume the lesion to be in the medulla near the nuclei of the vagus. A very small lesion so critically located might easily account for the relatively short clinical course. Also, the possibility of hemorrhage within such a tumor or transient edema might well explain the intermittent nature of the illness.

My second diagnostic choice—hemorrhage, probably from an aneurysm—seems unlikely for reasons similar to those given for a subdural hematoma—*i. e.*, the normal neurologic findings and absence of signs of meningeal irritation, the afebrile course, normal spinal fluid, and normal leukocyte count. Also, signs of cranial nerve involvement are often present in such instances, especially if the aneurysm is in the circle of Willis. An elevated blood pressure might be expected especially if the hemorrhage were sudden; and, if one postulates that each of the episodes over the 22-day clinical course was due to further hemorrhage, one might expect to see blood pressure changes at these times. Also, a chronic subdural hematoma from the rupture of a venous channel between the arachnoid and dura mater must be thought of. It would be possible in such a case to have a normal cerebrospinal fluid with fluctuating signs and symptoms. Papilledema may in such instances be absent.

Doctor Davenport:* In essence, we have the case of a young man with a negative past medical history who was admitted in coma. The

*Col. Merril C. Davenport, MC, USA, Chief, Department of Medicine.

night before admission he had been drinking, but not excessively. On the morning of admission he awakened, stated that he did not feel well, but went on duty. During the morning he complained of feeling worse and went to his barracks to lie down, where a short time later he was found semicomatose, mumbling incoherently, and holding his head as if in pain.

The diagnosis of cerebral vascular accident, and specifically hemorrhage, immediately comes to mind. We must think of primary subarachnoid and subdural hemorrhage. Subarachnoid hemorrhage, in the vast majority of instances, is due to rupture of an aneurysm. Most aneurysms are of the congenital or "Berry" type, but a few are syphilitic, arteriosclerotic, or mycotic in origin. At autopsy, about 8 per cent of a large series of patients with cerebrovascular accidents will have a primary subarachnoid hemorrhage. Such series show that this lesion appears to have its greatest incidence between the ages of 40 and 50 years. Premonitory symptoms are rare, but weeks or months before rupture occurs there may be paralysis of one or more of the cranial nerves due to pressure of the aneurysm. Focal signs are not noteworthy and if they occur are related to the site of the hemorrhage. Generalized symptoms such as headache, vomiting, convulsions, and coma are common. Coma as a presenting symptom occurs in 30 per cent of cases. Vomiting occurs in about 50 per cent and headache in almost 100 per cent. With a large hemorrhage, the temperature is usually elevated, the pulse rate increased, and the rate and depth of respiration altered. The blood pressure is usually elevated. Pupillary findings such as loss of accommodation to light and inequality in size are very common. Stiffness of the neck occurs uniformly. The cerebrospinal fluid is bloody in all patients with primary subarachnoid hemorrhage.

In subdural hemorrhage, a history of injury or the presence of contusions or lacerations of the scalp indicative of head injury is important. A period following injury in which the patient is relatively free of symptoms and then lapses into coma is very important in the differential diagnosis. A bloody spinal fluid under increased pressure may occur with either subdural or subarachnoid hemorrhage, as may focal neurologic signs, headache, coma, and alterations in pulse, respiration, and blood pressure. The patient under consideration could, from his history, have suffered either a subarachnoid or subdural hemorrhage. The diagnosis, however, could not be substantiated as there were no neurologic signs at admission, the spinal fluid was not bloody, and no evidence of cerebral injury could be found by either physical or roentgenographic examination. I do not believe that the history of the patient's interest in hypnotism or the bizarre statements which he had allegedly made are of any significance.

Doctor Hamilton:* The striking thing about this patient is the intermittency of his symptoms. However, there is no question that these

*Maj. George B. Hamilton, MC, USA, Department of Medicine.

symptoms were manifestations of increased intracranial pressure. Subdural hematoma, subarachnoid hemorrhage, or tumor are all capable of producing increased pressure. In view of nonbloody spinal fluid, the first two possibilities seem unlikely. Therefore, an intracranial neoplasm would seemingly be the only other logical explanation for the clinical picture presented in the protocol.

In view of the absence of neurologic signs, it is impossible to precisely localize such a tumor. However, the history of recurrent bouts of coma, headache, and syncope suggests two possible sites, namely, the third or fourth ventricles.

Tumors of the third ventricle may lie entirely within it, producing few symptoms and signs other than those of increased intracranial pressure. Characteristically, these manifestations differ from those produced by tumors elsewhere by being intermittent. Patients with such lesions may suffer from severe headaches which appear suddenly and which apparently are often precipitated by putting the head in a certain position. At times, such pain can be relieved by sudden nodding. These attacks are secondary to a transient hydrocephalus, produced by a "ball-valve" action of the tumor which suddenly obstructs the flow of cerebrospinal fluid. The blockage is relieved by movement of the head. Such episodes may be so severe that sudden coma and even death may occur.

Tumors of the fourth ventricle, on the other hand, produce increased intracranial pressure early by obstructing the ventricle and seldom give rise to other symptoms until late. Symptoms when present are not marked and may be in the form of unsteadiness of gait or tremor. Frequently, it is impossible to differentiate between a lesion in the fourth ventricle and one in the midline of the cerebellum.

On the basis of the characteristics of tumors located in either the third or fourth ventricle, I am inclined to make as my primary diagnosis an intrinsic neoplasm, possibly a colloid cyst, of the third ventricle. I believe that death was probably the result of an acute recurrence of blockage.

Doctor Lucas:* From the initial findings and history, one could have postulated that the patient's condition was due to trauma or to some toxic factor such as alcoholism or an overdose of drugs. The subsequent course and findings, such as the initial spinal fluid pressure of 290 mm of water with a second lumbar puncture of 600 mm of water, are suggestive of some cerebellar abnormality. I believe that the third spinal fluid pressure of 160 mm of water cannot be interpreted accurately inasmuch as Amytal Sodium is known to lower the spinal fluid pressure.

When one correlates the patient's apparently worsening state during hospitalization with the increased spinal fluid pressure and the history

*Capt. William G. Lucas, MC, USA, Chief, Neurology Service.

of unsteady gait, the question of a tumor of the posterior fossa should be considered. I am unable to account for the cause of the bilateral chorioretinitis and can see no connection between this and such a tumor.

One other comment is that I do not see the necessity for having done repeated spinal taps. With an increased pressure and an associated space-occupying lesion, there is the possibility of herniation of the cerebellar tonsils.

Doctor Davenport: Doctor Felton, do you have a comment?

Doctor Felton:* I have no other diagnoses to offer and would agree with those suggested, in the order given. The absence of history or evidence of trauma, of localizing neurologic signs, and of signs of toxicity suggests that there was no condition such as subdural or extradural hemorrhage or cerebral abscess.

The protocol up to the last sentence does not particularly indicate that other diagnostic procedures might have been of help. The fact that the patient did die suddenly, when associated with the previous findings, points to the intracranial location of his obviously organic disease. In view of this, the findings of carotid arteriograms or pneumoencephalograms would probably have been of considerable help diagnostically. It is doubtful, however, if there was sufficient clinical indication to recommend these studies at the time.

Doctor Van Hoorn:** In view of the intermittent character of the symptoms of this patient, which must have originated in the brain or brain stem, it seems possible to me that there had been recurrent bleeding in a tumor. This tumor could be a glioma.

Dr. Bealer's diagnoses:
Neoplasm, possibly in medulla, or ruptured cerebral aneurysm

Dr. Hamilton's diagnosis:
Neoplasm of third ventricle, possibly colloid cyst

Dr. Lucas' diagnosis:
Neoplasm of posterior fossa

PATHOLOGIC FINDINGS

Doctor Schulz: The significant pathologic findings were confined to the central nervous system. The brain weighed 1,400 grams, and the convolutions were widened with narrowing of the sulci. The brain was closely applied to the dura with little or no subarachnoid fluid visible over the vertex. There was no cerebellar pressure cone. The most striking feature grossly was the ballooning of the third ventricle to form a thin-walled cyst 3 cm in diameter. A needle inserted into

*Capt. Warren L. Felton, Jr., MC, USA, Chief, General Surgery Service.
**Maj. Jacob Z. Van Hoorn, MC, USA. Department of Medicine.

the right lateral ventricle withdrew 100 ml of clear cerebrospinal fluid with resulting collapse of the bulging third ventricle.

A midline sagittal section made in the fresh state showed slight dilatation of the anterior portion of the aqueduct of Sylvius with occlusion at the level of the inferior colliculus. The lining of the dilated portion of the aqueduct was ragged and slightly injected. After fixation, a 2-mm spherical mass could be recognized in the subependymal region of the mesencephalon, protruding into and partially obliterating the aqueduct (fig. 1). Multiple cross sections of the brain showed moderate

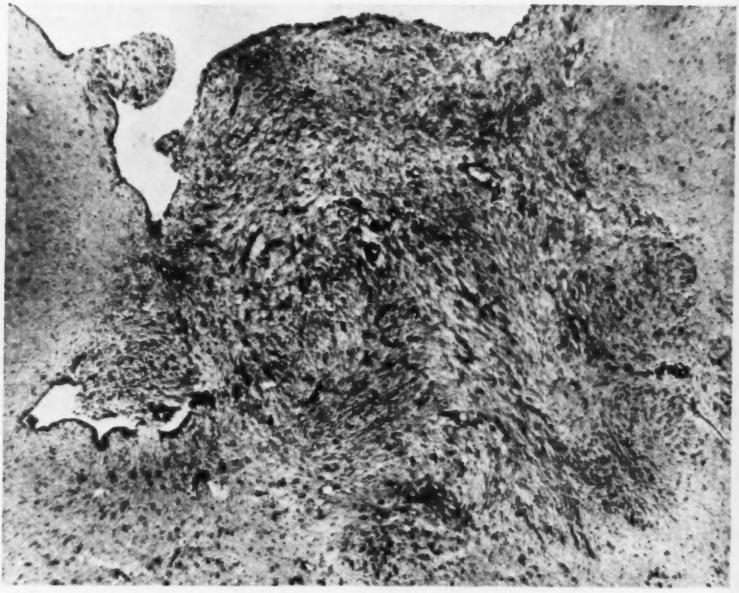

Figure 1. Section of mesencephalon showing the spherical tumor in the subependymal region that protrudes into the aqueduct.

dilatation of the lateral ventricles, extreme dilatation of the third ventricle, and no abnormalities of the fourth ventricle. The ependymal linings were smooth and glistening.

Microscopically, the tumor was composed of intertwining bundles of fibrillary processes with relatively few nuclei. The cells were distributed irregularly (fig. 2) with no evidence of anaplasia and only rare mitotic figures. Sections taken from 1 to 2 mm anterior to the main tumor showed dilated aqueduct with the ependyma interrupted by tufts of proliferating astrocytes and fibrillary processes (fig. 3).

This neoplasm belongs to the group described by Boykin and associates[1] as subependymal glomerate astrocytomas. Because of the

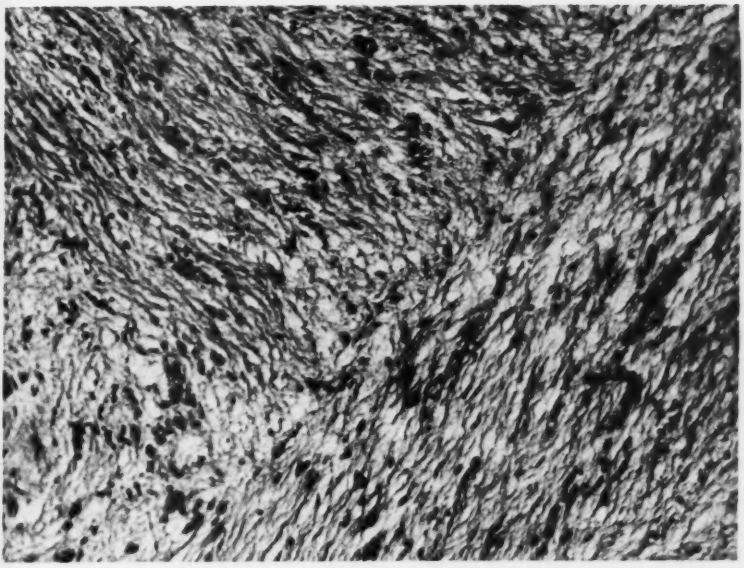

Figure 2. Photomicrograph of the subependymal glomerate astrocytoma.

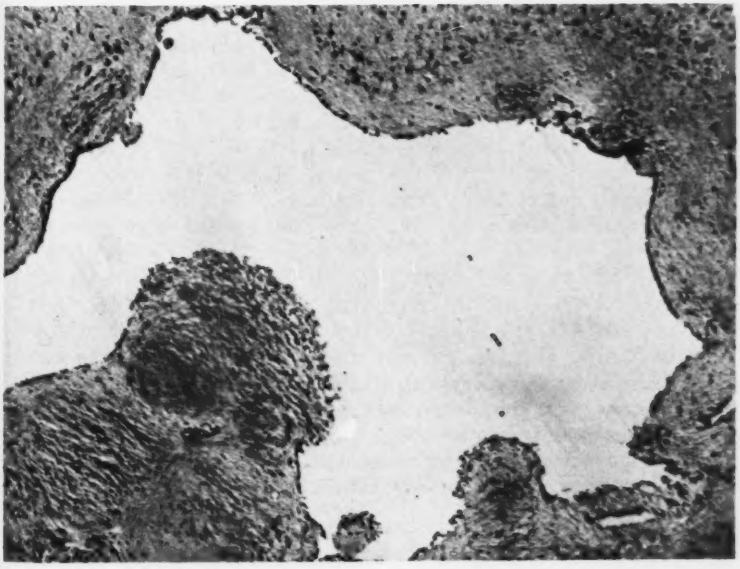

Figure 3. Section of aqueduct showing interruption of the ependyma by tufts of proliferating astrocytes and fibrillary processes.

strategic location, neoplasms of this type in the aqueduct are probably the smallest that can cause death.

Pathologic diagnoses:

1. Astrocytoma (2 mm) of mesencephalon with obstruction of aqueduct of Sylvius
2. Dilatation of anterior portion of aqueduct, moderate
3. Dilatation of third ventricle, extreme; of lateral ventricles, moderate

REFERENCE

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MANAGEMENT OF INTRACRANIAL BLEEDING

"The general practitioner and specialist may be called for advice after the catastrophic collapse of an apparently healthy individual. The sudden onset of profound neurological signs and symptoms in such a patient always suggests intracranial hemorrhage. All patients suspected of having intracranial bleeding should be subjected to prompt cerebral angiography to determine the pathological nature of the lesion. In analyzing 100 cases of this type with cerebral angiography, a definite vascular malformation was demonstrated in 69 percent. A positive diagnosis as to cause or associated manifestation was made in 85 percent of the cases. While there are certain inherent risks in angiography, no additional complications appear to have been introduced into the treatment of intracranial bleeding by having performed the procedure, even as early as two hours after the presumed onset of the bleeding. Such risks as may exist seem minor in comparison with the existing risk of the lesion itself. In cases of ruptured aneurysm of the circle of Willis, the survival rate following neurosurgical intervention is 75 percent. In a smaller but comparable group, those treated by conservative means had a survival rate of 18 percent. Indicated surgical intervention is actually the conservative therapy for intracranial bleeding."

—MAURICE L. SILVER, M. D.
in *Journal of the American Medical Association*, p. 1097, March 30, 1957

MENTAL ILLNESS AND CLASSIFIED INFORMATION

MORTIMER V. KLEINMANN, Jr., *Major, MC, USA*
EDWARD F. KRISE, *Captain, MSC, USA*

THE medical profession and the public are both becoming more sophisticated in their attitude toward mental illness. Almost everyone knows that half of our nation's hospital beds are occupied by the mentally ill. Slow progress is being made toward improving our institutions and there is some evidence that the various legislative bodies are taking cognizance of the problem. However, when a psychiatric disturbance occurs close to home, in the family, in the organization or in someone we know, it is still regarded with fear and sometimes panic.

Nowhere is this more severe than when it occurs in a civilian or military person who has had access to classified material. It is immediately assumed that our entire security is at stake and that local or national secrets are about to be spread abroad for the perusal of enemy agents.

When evaluating a person as a security risk from the psychologic standpoint, we are concerned with whether or not an illness or personality deviation exists which impairs his ability or judgment with regard to classified information. Executive Order 10450 states that "an adjudication of insanity, or treatment for a serious mental or neurological disorder without satisfactory evidence of cure" disqualifies a person from receiving a security clearance. Special Regulation 380-160-2 adds the following factors as raising a presumption of a security risk: "conviction for or manifested tendencies of hemosexuality; conviction of felonies indicating habitual criminal tendencies; addiction to the use of alcohol or drugs habitually and to excess, without adequate evidence of rehabilation."

While these orders spell out certain requirements, it usually evolves upon the local physician to determine whether or not these requirements are being met. Such phrases as "serious," "evidence of cure," and "rehabilitation" require considerable individual evaluation and interpretation. Let us consider some

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of the more common forms of mental illness from the standpoint of their being security risks.

NEUROSES

In considering the attributes of neurotic people in general, we do not believe that the presence of a neurosis automatically presupposes the existence of a security risk. We know that the neuroses are internal problems. They are conflicts existing within the individual between his impulses (usually unconscious) and his ability to control them. He may be anxious, he may be hypochondriacal, or he may be compulsive, but he is not disoriented and his conflict is not between himself and the environment. Even in the phobias where the individual responds with inappropriate fears to some situation in the environment we know that these stimuli are symbolic of some unconscious and internal conflict.

Usually the neurotic is a worrier. He expends a great deal of his psychic energy in introspection. Generally, his circle of friends is small because he does not generate the warmth and outgoingness that encourages interpersonal contacts. Frequently, he is a very conscientious worker transferring much of his concern and compulsiveness to his job. This is not to say that every neurotic individual should be cleared for every job. On the contrary, there may be many reasons why a neurotic should be denied a clearance. His stress threshhold may be low. His hypochondriacal tendencies may cause him to lose much time from important work and his various phobias may definitely limit his flexibility in a particular assignment. On the other hand he may have many skills to offer. In such cases a careful evaluation of the individual in terms of his job would seem indicated.

One might carry the argument further, to a theoretical plane which is beyond the scope of this paper, and arrive at the conclusion that in some cases certain types and degrees of neuroses actually reduce the likelihood of an individual's being a security risk. In any event, the authors have never seen a case in which the presence of a neurosis resulted in a breach of security.

PSYCHOSES

The psychoses are an entirely different matter with regard to protecting classified information. When a psychotic condition is found to exist in a patient, the assumption is made that the individual is not responsible for his actions and, therefore, should not have access to classified material. This assumption is not universally true inasmuch as many a law-abiding schizophrenic is earning his living and rearing his family unobstrusively or, at times, bearing only the label "eccentric." In general, however, one cannot predict the course of a psy-

chosis with sufficient accuracy to justify granting a security clearance.

Despite the foregoing, an actual breach of security due to the existence of a psychosis is a rarity. In the functional psychoses the patient frequently tends to become markedly withdrawn and isolates himself from other people. Exceptions to this are the manic and certain phases of the paranoid and catatonic schizophrenias. Because it is sometimes difficult to determine the exact type of psychosis which exists early in the disease process, one is never justified in taking chances once the condition is detected. Primarily the psychotic individual (manic, depressed, or schizophrenic) represents a severe actual or potential danger to himself, to those around him, and of course to the military mission of his unit. Because most of these conditions become clinically apparent slowly, forecasting themselves with eccentric behavior, it is usually possible to take the necessary protective measures before serious damage is done.

TOXIC REACTIONS

The toxic reactions present another picture. They are frequently sudden in onset and may be due to the administration or withdrawal of drugs, the imprudent use or withdrawal of alcohol, some febrile illness such as pneumonia, or more commonly some combination of the foregoing. The patient suffering from a toxic reaction is usually delirious and may babble incoherently. In our experience the combination of pneumonia and withdrawal from alcohol in a person habituated to its excessive use has constituted the most common security embarrassment. It is not necessary to postulate the improbable condition of an enemy agent being present during such an episode to meet the requirements for a breach of security. The dissemination of classified information, even in delirious fragments, to people who have not been properly cleared and briefed, regardless of their loyalty is to be avoided whenever possible.

CHARACTER AND BEHAVIOR DISORDERS

This group, which includes personality disorders, sexual deviations, and immaturity reactions, represents the most common threat to local and national security. Most of these people look normal and appear to behave in a normal manner most of the time. Many of their deviations from the normal are handled at the unit level without ever coming to the attention of the security officer or the physician. Frequent AWOL's, excessive indebtedness, and more than an occasional brush with the local police may be indicative of an emotional limitation which makes the individual a poor security risk. Less detectable and, therefore, more dangerous, are the tavern braggart, the immature

security guard who must impress his girl friend with his importance, and the near deviate who habituates disreputable sections of town "just for kicks." The undetected homosexual is regarded as a risk, not so much from the danger of his being blackmailed, although this exists, but because of the rapidity with which he may make strong emotional attachments to persons of short acquaintance.

Most people live double lives within themselves, satisfying their aggressive needs and frustrated desires through phantasy and sublimation. The people in the character and behavior disorder group tend to act out their impulses much as the child does when he plays cops and robbers or fancies himself as the current western hero. The blend of phantasy and reality can be so subtle that the individual may be hard pressed to separate them, resulting in remarkably poor judgment as to what is possible and what is not, or what is safe and what is unsafe. This frequently results in a legal controversy over whether or not these people are responsible for their actions. It is generally believed that they are, but each case must be judged on its merits. The important thing is that people in this group are usually not detected until after they have been assigned sensitive jobs and may have already compromised the security of their unit.

EARLY TREATMENT

The physician who first sees a mentally disturbed person who has had access to classified material is called upon to answer several important questions. What condition does the patient have? How serious is it? How long may it be expected to last? Does it constitute a security risk and if so what special precautions are indicated? Most important is the decision as to how the case is to be handled from the very beginning.

Neuroses. The patient who is suffering from a neurosis will frequently present himself voluntarily to the physician with his emotional problem, or after adequate evaluation of the patient's organic complaints the physician may decide that the problem lies in the emotional sphere. Very often the patient has already suspected this or accepts it after brief token resistance during which he says, "But surely my emotional problems couldn't cause my chest pain" or "But doctor, this pain is real. I'm not imagining it." The doctor's genuine acceptance of the pain as real and his firmly expressed opinion that emotional disturbances can cause the patient's symptoms may be all that is necessary to orient the patient toward the cause of his illness. Certainly, some patients will reject this concept completely and insist that an organic cause must be found. The physician who allows himself to be duped into performing numerous physical examinations and repeated laboratory pro-

cedures only serves to reinforce the patient's opinion that he, indeed, has some physical illness.

In those cases where the patient recognizes that he has an emotional problem and is ready to talk about it, another difficulty arises. The patient's security clearance may be higher than that of the physician. The therapist must then inform the patient that this situation exists and insist that nothing of a classified nature be brought up. This problem is more apparent than real since in most people the difficulty has existed for some time and rarely relates to a specific job. This is particularly true when the job is highly specialized and the patient is an expert in his field. It is less applicable when the job is routine and the patient relatively untrained as in the case of a security guard whose job "gets on my nerves." Usually the largest portion of the difficulty will be found to lie in the realm of interpersonal relationships between the patient and people who have had an important influence on his personal life such as parents, siblings, wife, et cetera.

The physician who has not had psychiatric training will certainly not wish to embark upon a course of long-term psychotherapy. His prime motive is to ameliorate the patient's distress sufficiently to allow him to remain at his job. Frequently this may be accomplished by merely affording the patient the opportunity of discussing his problems in confidence with someone whom he knows is not going to reveal what is said during the interview. Very often confused issues are clarified remarkably when the patient is required to put into words what had once been vague concepts and unexpressed and diffusely felt hostilities. Through all this the doctor plays the role of a listener. He does not enter into an active critique of the patient's thoughts or activities. He certainly does not play God and offer specific advice about such things as marriage, divorce, or change of jobs or career fields. These are decisions the patient must make for himself when he has attained a better understanding of the factors involved.

Even if the therapist admits that a plan proposed by the patient appears to be reasonably sound, in the event of failure this may come home to roost as a direct accusation that the plan was specifically suggested and encouraged by the doctor. Principally the doctor just listens and may occasionally point out the apparent existence of mixed feelings which seem to be contributing to the patient's difficulties. This is not psychoanalysis. It does not deal with basic unconscious drives or the Oedipus complex. This listening type of therapy is designed solely to allow the patient to express his feelings accurately so that they become clearer to him and thus easier to deal with.

Not all cases are amenable to this type of therapy and the physician must particularly avoid any dramatic technics in which he attempts in one or two interviews to reveal to the patient the "deep, underlying, unconscious" cause of his neurosis. Usually he will fail to impress the patient at all but occasionally he may uncover material which he is not competent to handle and do serious harm to his patient. In any case where the physician feels that the patient's illness seriously interferes with the performance of his duties or the physician doubts his own ability to handle the situation he has no other course but to recommend transfer to a general hospital with neuropsychiatric facilities. As long as the patient is well oriented and responsible for his actions no special security measures are indicated beyond notifying the security control officer of the patient's admission to the hospital and proposed transfer so that debriefing can take place and a replacement obtained if necessary.

Psychoses. The psychotic patient presents a simplified but sometimes urgent problem. As long as he is in a psychotic state and not responsible for his actions he must be regarded as a security hazard. He must be isolated and attendants provided. The security officer should be notified so that appropriate steps can be taken to protect confidential material or information for which the patient was responsible such as codes, safe combinations, keys and passes to restricted areas, et cetera. It is also necessary to brief attendants regarding their responsibilities toward any classified information to which they may be exposed.

Within a short time after admitting the patient the physician will be required to express an opinion as to the severity of the illness, the likelihood of the patient returning to duty in a short time, a long time, or never, and finally as to whether the current illness represents a security hazard in regard to future assignments. The question of arranging an emergency transfer of the patient to a general hospital will also arise and may seem to require an urgent decision.

The answers to these questions will be determined, for the most part, by (1) the clinical state of the patient, and (2) the physician's diagnosis. It is possible that the doctor's own anxieties about mental illness and the bizarre forms in which these conditions present themselves may lead him to attempt a rapid diagnosis and disposition of the case. A reasonably thorough physical examination and a good history taken from the patient, his relatives, associates, and superiors will do much to reduce the confusion and assist in charting a course. The desire of the physician is to help the patient, and, in the cases we are discussing, to protect security as much as possible. Rapid transfer of these patients may not do this and indeed

may only serve to increase the security hazard by exposing the patient to numerous other people with inadequate clearance.

An early, but tentative, decision should be made concerning whether the patient's mental aberration represents a primary psychiatric process such as schizophrenia or a manic-depressive psychosis or whether it is secondary to some other condition of an infectious, toxic, or cardiovascular nature, et cetera. If the patient belongs to the latter group, treatment directed at the basic illness will usually alleviate the psychiatric symptomatology to the extent that the patient need not be evacuated as a psychiatric case and may not require evacuation at all. Most toxic reactions are of short duration and subside as the fever comes down, the basic infection is brought under control, or a reasonly normal physiologic balance is restored. Every city hospital and almost every physician has a favorite "cocktail" which is administered to the patient suffering from delirium tremens or alcoholic hallucinosis. These have largely been replaced by the ataractics which are reasonably safe and rapid in action. By using their sedative effect the physician allows himself time to evaluate his patient more critically and is in a better position to decide on the necessity of a transfer.

In the case of the alcoholic, where the doctor cannot give reasonable assurance that the condition will not be repeated, it may be necessary to transfer the patient to another post. However, the ends of security may be better served if the patient is given a less sensitive job within the original organization, provided he is able to perform other tasks satisfactorily.

In the case of the functional psychoses, particularly the schizophrenias, ultimate transfer to a general hospital should be planned. Admittedly, the physician in the station hospital or outlying medical installation is faced with a real problem when he attempts to provide care for a psychotic patient without closed-ward facilities. The absence of an adequate restraint section and trained closed-ward personnel may seem to present an overwhelming problem, the only answer to which is heavy sedation of the patient and immediate transfer out of the area.

Here again, the need for haste may be more apparent than real. Although the psychotic is considered to be mentally incompetent, large areas of his personality frequently remain intact. This is particularly true in the early stages of the illness at the time when the doctor in the station hospital is most likely to see the patient. A kindly, accepting, and professional attitude may do much to calm an anxious and hostile patient and may make the difference between a patient who can be handled routinely and one who throws the area into a turmoil and taxes the abilities of all concerned.

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Not infrequently the patient has suspected that something was wrong for some time and, although frightened and suspicious, is anxious for help and will move in a positive and co-operative manner toward the physician who offers protection and assistance. For this reason the use of subterfuge should be scorned. A straightforward and honest approach is indicated. Within the limits of his ability to comprehend, the patient should be advised as to what is being done for him. In answer to his questions concerning his isolation and the presence of attendants, he can be told frankly that the doctor believes that he is emotionally upset at the present time and that this arrangement is considered necessary.

To the uninitiated it might seem that this would be just the thing to set the patient off on a wild attempt to escape. Experience indicates the contrary. Since the patient is extremely sensitive to all that is going on about him he will be quick to sense an honest approach and although he may disagree with the doctor's opinion, he will feel better able to cope with what he considers to be an honest error rather than something he thinks is a plot to incarcerate him.

Sedatives may be necessary and should be selected and used with due regard to the physical condition of the patient. Barbiturates, particularly amobarbital sodium given intravenously, can be used to calm the very hyperactive patient, but the physician should not be surprised to discover that even an anesthetic dose has only a short effect. Of the newer drugs, promazine hydrochloride, given in adequate dosage, is the author's choice. Large doses are to be avoided in the hypertensive or cardiac patient. In the otherwise healthy patient the drug is generally considered to be quite safe and the rapid administration of the necessary dosage may be attempted. We start with 100 mg of promazine given orally or 50 mg intramuscularly every two hours until the desired effect is obtained. Between doses the patient is watched carefully for signs of excessive drowsiness or a precipitous fall in blood pressure. Clinical improvement is frequently obtained with the first dose. If the patient shows no untoward response to the drug initially the dosage schedule may be accelerated as necessary. When it has been established that the patient tolerates the drug well, intramuscular administration of higher doses can be used when a very rapid or more pronounced effect is desired.

Once the acute phase has been brought under control the physician may begin making realistic plans for the transfer of his patient. The degree of security information involved may well determine the place to which the patient is transferred and the method of transportation. The receiving installation should certainly be advised of the situation well in

advance of the patient's arrival. Alerting the security officer at the general hospital to which the patient is being transferred helps to reduce the possibility of a security break after the patient has left the control of his own medical unit.

The handling of the psychotic patient at the local installation may be summed up as follows:

1. Attempt to bring the acute phase under control prior to transfer.

2. Work closely with the local security officer with particular regard to the selection and briefing of attendants and the protection of any classified information or material to which the patient may have had access.

3. Alert the receiving installation as to the situation both through medical and security control channels.

Character and Behavior Disorder Group. The role of the medical service in the handling of personnel with character and behavior disorders would appear to be rather poorly defined. Administrative methods of disposition recommended by boards convened under the provisions of AR 635-208[1] and AR 635-209[2] frequently bypass medical channels, and if the physician is asked to see these cases it is usually only for the purpose of ruling out any condition which might warrant the individual's appearance before a medical board. By the time the doctor is consulted, the subject may have been involved in sensitive work for many months or even years. The man's commanding officer has had to wait until the individual's transgressions or inaptitude has not only become readily apparent through repeated actions but has also resisted the required attempts at rehabilitation.

In routine military assignments the above procedure has demonstrated its value, but where security information is involved it may not be feasible to wait so long. Early detection of those persons who represent potential security hazards because of personality patterns can be facilitated by a little extra effort on the part of the local physician. The commanding officer of any unit charged with a sensitive military mission is certainly going to be receptive to any reasonable procedure or policy which enhances his security control. The doctor, through contact with unit commanders, should encourage the early referral of those servicemen and civilians who show evidence of poor personality traits such as immaturity, frequent AWOL's, apparent inability to handle routine personal problems, excessive indebtedness, and difficulty with the local police.

In many cases a recommendation for administrative discharge will not be indicated, but a transfer to a less sensitive position

within the unit or even to another area may be in order. The screening of all incoming personnel would put an excessive burden on the doctor and is not practical, but the selective interviewing of those individuals whose previous performance suggests that they may fall into the groups we are discussing will undoubtedly increase the integrity of the unit with regard to protecting classified information. It is certainly consistent with the responsibility of the physician that he work closely with his commanding officer and the security officer in the protection of his unit through the early detection and elimination of those people who represent actual or potential security risks.

SUMMARY

Mental illness represents a threat to national security and often poses a difficult problem in medical management.

The presence of a *neurosis* does not presuppose the existence of a security risk. Only through careful evaluation of the manifestations of the illness in relation to the demands of the job can the existence of a security threat be determined.

Because the course of a *psychosis* cannot be predicted with accuracy, psychotic patients should be relieved of their security clearance even though an actual break of security due to the existence of a psychosis is, in our experience, a rarity.

Persons suffering from *character and behavior disorders* represent the most common threat to national security when placed in sensitive positions. The early identification and effective administrative management of such patients through the close co-operation of physician, unit commander, and security officers can reduce the hazards associated with these disorders.

We have emphasized the importance of early treatment, the danger of rapid and poorly planned evacuation, and the necessity for integration of the skill of the physician and the function of the security officer. Basic psychologic and medical technics that may be employed by the physician who is faced with the problem of mental illness in patients who have access to classified information have been suggested.

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FLIGHT INDOCTRINATION PROGRAM

At a United States Marine Corps Air Station

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TWO years ago a new program of aviation selection was instituted at this activity in an attempt to lower the high attrition rate of U. S. Marine Corps aviation candidates in the Naval Air Training Command. There are many variables that enter into attrition rates, but the results achieved to date must be considered most favorably.

Under the old regime, various categories of flight applicants were ordered to the U. S. Naval Air Station, Pensacola, Fla., from all sections of the United States, upon successful completion of their flight aptitude tests and flight physical examinations. At present, the majority of Marine Corps aviation candidates, Regular or Reserve, are processed at this air station prior to receiving orders for flight training. These officers and men are obtained from several sources which include:

1. Unrestricted commissioned officers who have successfully completed, or are in attendance at, a Basic Course at the Marine Corps Schools, Quantico, Va., at the time of application.

2. "Platoon Leaders Class (Aviation)" program consisting of college students who receive two six-week periods of training prior to their senior year of college during two summer vacations from college. Those who desire flight training are administered flight physical examinations, flight aptitude tests, and further indoctrination as outlined in this article during the second six-week training period. After graduation from college and when commissioned, they are ordered to report to this air station in order that their physical qualifications may be reaffirmed.

3. Aviation officer candidates, who are recent college graduates and who receive at Marine Corps Schools, Quantico, a 10-week training course leading to a commission, followed by assignment to flight training.

4. Enlisted personnel selected for assignment to flight training who are assigned to the Marine Corps Schools.

From U. S. Marine Corps Air Station, Quantico, Va.

Candidates from any of these sources who fail to qualify are immediately returned to their nonaviation duties without undue loss of time or money. Those who do qualify are ordered to Pensacola for training as student naval aviators for a period of about 18 months.

A complete flight physical examination, including refraction, is given to all applicants, even though they have been previously qualified. During the 24 months covered by this report, 41 such candidates were rejected for physical defects. Causative factors in most instances have been (1) the lengthy interval between time of original examination and reporting here; (2) hasty examinations, possibly due to the pressure of recruiting programs; and (3) previous passing of some applicants following "eye exercises" from civilian sources.

The U. S. Navy Aviation Selection Tests[1] are given to those candidates not having previously passed them, provided that an interval of at least one year has elapsed since a previous failure, as well as to those who have never been given the tests. These written examinations take about three and one-half hours to complete, and are preceded by a brief explanatory talk by a flight surgeon. They consist of:

1. Aviation Qualification Test, which is primarily a test of general intelligence.

2. Flight Aptitude Rating Battery (FAR), which is divided into three different written tests: (a) The Mechanical Comprehension Test, which deals with the ability of the individual to perceive physical relationships and handle familiar concepts of everyday mechanics rather than technical matter found in textbooks. This test has been found to be most useful in predicting success in the flight training program. (b) Spatial Apperception Test, designed to measure ability to visualize the relationship between the attitude of a plane and the territory over which it flies. (c) Biographical Inventory, an untimed questionnaire containing elements of personal history, expressions of interests and attitudes, and selected informational items that have been found to differentiate between passing and failure groups. Those receiving passing grades in the Selection Tests are then scheduled for a flight physical examination at the rate of 20 a day until each group is completed.

Upon final approval by the Bureau of Medicine and Surgery, those found to be physically qualified and aeronautically adapted for duty involving flying are scheduled to receive four indoctrination flights, each of one-hour duration, in the T-34 training aircraft. The purpose of this flying is to minimize attrition of Marine officer students at Pensacola. It does so in two ways. First, it lets the applicant experience the sensations and problems of single-engine aircraft flying, thereby shaping his own

decision—"You like it." Second, it provides the Marine Corps Schools Flight Interview Board with more basis for its recommendations concerning the applicant's suitability—"It likes you."

Flights are preceded by a briefing on emergency and cockpit procedures, and include rudiments of ground operations and fundamental flight maneuvers. Applicants follow through on controls. Aerobations or abrupt maneuvers are forbidden. The pilot reviews each flight with the applicant, then writes up the applicant's reaction to what he has experienced.

The fourth and final step is the meeting with the Flight Interview Board which is chiefly concerned with the determination of the motivation of the applicants for flight training. It indicates by endorsement, on each application, its recommendation in this regard to the Commandant, U. S. Marine Corps. It is noted that the academic and leadership performance of those applicants in, or graduates of the Basic Course, Marine Corps Schools, are considered by the Board as a direct reflection of his motivation.

From February 1955 through February 1957, a total of 1,733 flight applicants were examined by this medical department. Of these, 904 (52.16 per cent) were found to be physically qualified and received passing grades in their Flight Aptitude Tests. (Over 1,100 flight physical examinations having no connection with this program were also conducted during the two-year period.)

Of the 904 candidates accepted medically, 41 (4.53 per cent) voluntarily withdrew prior to their first flight and 63 (6.96 per cent) voluntarily withdrew following one or more flights. Of the remaining 800 applicants, 101 (11.37 per cent) were rejected by the Flight Interview Board. Of the physically qualified candidates, 684 (75.66 per cent) completed indoctrination flights and were finally accepted by the Flight Interview Board. The slight difference in final totals can be explained by the fact that a few candidates were either not recommended for commission, were hospitalized for illness or injury, or were subsequently rejected by the Bureau of Medicine and Surgery.

Most frequent reasons given by those who dropped at their own request were (a) loss of interest, (b) family opposition, (c) decision not to extend their period of active duty, and (d) the extensive time element required for flight training.

CONCLUSIONS

Testimony has been given to Congress by the services' witnesses, as far back as 1955, that the cost of flight training is estimated to be about $120,000. Informal estimates from the Flight Training Command indicate that the *direct* cost of pro-

ducing a naval aviator is approaching $115,000. A total of 220 candidates either withdrew voluntarily or were rejected by the Flight Interview Board; 41 additional applicants who had previously passed their flight physical examinations were rejected by the Quantico medical department.

Assuming that all 261 candidates not qualified would have been eliminated during the early stage of their flight training, a great monetary saving to the Government would be represented. It is quite conceivable that some of the candidates would advance to later stages of training at even greater cost. In addition, much reduction in lost time, waste of manpower, and inconvenience to all concerned is represented. As previously stated, those who fail during any one of the four stages of this indoctrination program are immediately returned to their original place of duty.

The U. S. Marine Corps recruiting program also has apparently been assisted by the enthusiasm of the members of the Platoon Leaders Class following their brief experience with aviation. The best judges are the procurement officers in the field, and they contend that they are helped immeasurably by the interest created not only among those given the flights, but also in the number of friends influenced by the candidates.

The final attrition rates for the years 1955 and 1956, based upon 16 to 18 months of training, have not been completed. In summary, we can only quote the following excerpts from a Special Report issued by the U. S. Naval School of Aviation Medicine.

"Differences in the over-all attrition rates are actually reflections of the difference in the DOR (dropped on request) rate among various groups. Although there are few variations in rates between groups for other types of attrition, none of these variations is significant. The significant differences among the groups are for voluntary withdrawals only.

"Another figure which stands out is the relatively low Marine Corps officer DOR rate, since they were at one time a high DOR group in comparison with other OI's (officer under instruction): Apparently their screening and flight indoctrination program has paid off in reduced attrition."[2]

We are of the opinion that the Marine Corps attrition rate will be even lower when the final results of the past two years' flight training have been ascertained. This low rate is a result of more rigid adherence to flight physical examination standards, giving candidates an opportunity to actually experience basic flying, and careful screening prior to assignment to flight training.

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WHAT PRICE PEACE OF MIND?

"It is a rapidly moving world we live in, growing more and more complex year by year. Great social changes are going on. The improvements in communication have exposed each of us to many new stimuli. If we cannot react to them satisfactorily they call forth in us anxiety and hostility. An increasing number of people cannot enjoy being quiet, undisturbed and alone.

"In order to adapt successfully to this new world one must take thought. One must know one's self. One must contemplate with some objectivity his relationships with other persons, and learn to understand his own reactions. Many will need the help of psychiatrists to accomplish this . . . .

"If we take the easy way and merely "tranquilize" our patients with new or old drugs, we may seduce them into a bogus health, but it will weaken their adaptive capacities. Our patients will lose some of the keenness needed to live in this accelerated world; there may be more traffic accidents and the cult of relaxation may degrade our morale. If we psychiatrists surrender to this easy kind of therapy, and give up the careful study of our patient's problems, we might as well let the manufacturers of the "tranquilizers" contract with the municipalities to put tons of drugs into the reservoirs of drinking water. Then everybody will relax.

"No psychiatrist would subscribe to such a ridiculous notion. Our aim is to make patients responsible and at peace with themselves. For those patients capable of adaptation there are no cheap, wholesale shortcuts. Lasting peace of mind can be bought only dearly, by self-knowledge."

—Editorial
in *American Journal of Psychiatry*
p. 663-664, Jan. 1957

CASE REPORTS

Larval Granulomatosis

Diagnosis by Needle Biopsy of the Liver

OGDEN C. BRUTON, *Colonel, MC, USA*
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LARVAL GRANULOMATOSIS (visceral larva migrans) as a clinical entity causing extreme degrees of eosinophilia associated with visceral granulomatosis in children ingesting polluted soil is well documented.[1] The dog and cat ascarides have been thought to be the main offenders; however, other larval forms not accustomed to the human host in their normal life cycle have also been identified.[2,3] The diagnosis of the condition may be strongly suspected from routine clinical data; however, the diagnosis can only be made by finding the larvae in body tissues. Usually the liver has been the tissue studied ante mortem, although the brain, lung, heart, and other organs have harbored the larvae in post-mortem specimens.[3] Liver tissue has been obtained for such study during abdominal exploration. It has been stated that the diagnosis will be infrequently made "as long as laparotomy is the only means of specific diagnosis."[4] The ease with which liver needle biopsy in children may be done has been pointed out,[5] and its use in suspected larval granulomatosis is demonstrated by the following case report.

CASE REPORT

A two-year-old boy was admitted to the hospital with fever, cough, general malaise, and enlargement of the abdomen of one-month duration (fig. 1). There were four siblings, three to eight years of age, in good health. The mother had allergic rhinitis. The father was overseas and in good health. When the mother delayed coming to the hospital, a home visit revealed the family to live in "total filth." Several dogs of various ages were owned by neighbors, although the boy's family had no pets. The patient was said to spend much of his playtime picking dirt from between the cracks in a paved walkway and eating it.

The patient had "pneumonia," six months prior to admission, which lasted a month and appeared to respond completely with the use of antibiotics.

From Tripler U. S. Army Hospital, APO 438, San Francisco, Calif., and Walter Reed Army Hospital, Washington, D. C.

Physical Examination. On admission, the patient appeared both acutely and chronically ill, with a prominent abdomen caused by an enlarged spleen and liver, which were 6 and 5 cm below the costal margin. The nasal mucous membranes were wet and swollen and appeared to be of the allergic type. The tonsils were large and hyperemic with exudate on both. There were coarse rales and rhonchi throughout both lung fields. The fundi were normal.

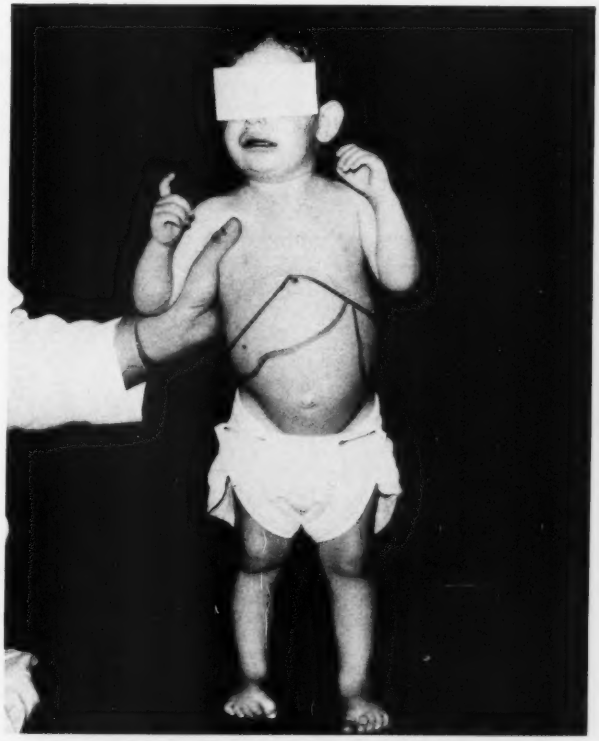

Figure 1. The abdominal enlargement is obvious in this photograph of the patient. The liver and spleen have been outlined on the abdomen.

Laboratory Findings. The white blood cell count was 48,000 per μl with a differential count of 13 per cent neutrophils, 21 per cent lymphocytes, 65 per cent eosinophils, and 1 per cent basophils. Hemoglobin was 8.7 grams per 100 ml. Bleeding time, coagulation time, platelet count, urinalysis, and blood culture were normal or negative. The total serum bilirubin was 0.4 mg per 100 ml; cephalin-cholesterol flocculation, negative; thymol turbidity, 9 units; alkaline phosphatase, 9.2 Bodansky units; and total blood protein, 10.2 grams per 100 ml with

albumin 2.7 grams, giving an albumin-globulin ratio of 0.4. Electrophoretic analysis of the blood serum proteins gave a total of 9.48 grams per 100 ml with 44.5 per cent albumin, alpha$_1$-globulin 3.5 per cent, alpha$_2$ 8.3 per cent, beta 9.8 per cent and gamma-globulin 33.8 per cent. Stool specimens contained no blood, ova, or parasites. Skin tests for tuberculosis, histoplasmosis, coccidioidomycosis, and blastomycosis were negative. A study of the bone marrow was interpreted as showing hyperplasia with marked increase in the number of eosinophils and eosinophilic precursors.

Course in Hospital. On penicillin and streptomycin therapy the patient's acute respiratory signs and symptoms subsided rapidly. The clinical impression was that this child represented a rather typical example of granulomatosis caused by visceral larva migrans. Accordingly, one week after admission, when his acute respiratory infection had subsided, a liver needle biopsy was performed. The biopsy specimen revealed multiple granulomas (fig. 2) in various stages of develop-

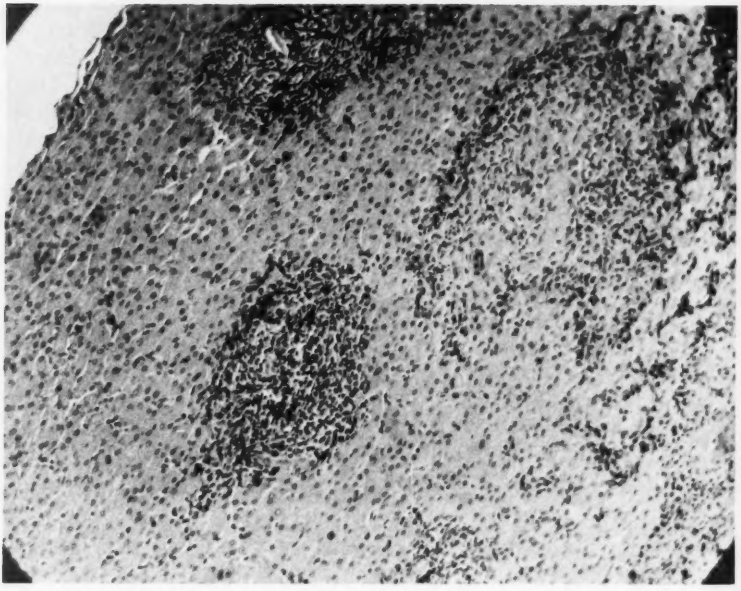

Figure 2. Granulomas in the liver biopsy specimen. (× 125)

ment, apparently localized in the vicinity of the vascular channels. A few larvae of *Toxocara canis,** lying within granulomas were found after many sections were searched (fig. 3). Because of the obstructive

*Identified by Dr. Paul C. Beaver, Professor of Parasitology, Tulane University School of Medicine.

nature of the tonsils he had an uneventful tonsillectomy and adenoidectomy before his discharge one month after admission. There was no change in his white blood cell count or eosinophilia, and his spleen and liver remained enlarged. No specific treatment was attempted. Measures to prevent more infection were strongly advised at the time of discharge.

Figure 3. Toxocara canis *larva in liver.* (× 450)

Subsequent Course. Follow-up investigation one year after study found the family still living in circumstances conducive to continued infection. The patient's liver was 2 cm below the costal margin and the spleen, 3 to 4 cm. A roentgenogram of his chest was reported as normal. His white blood cell count was 18,200 per μl with a differential count of 22 per cent neutrophils, 33 per cent lymphocytes, and 45 per per cent eosinophils. The hemoglobin was 10.8 grams per 100 ml.

DISCUSSION

That certain parasites are unable to continue their life cycle in a foreign host and spend their life meandering through various tissues is a fascinating story. However, it becomes disturbing when one suspects the probable widespread casual infection in man, with or without clinical manifestations. That this high

degree of casual infection does exist is supported by studies revealing a majority of cats and young dogs harboring parasites[4] and the almost universal close association of man with these animals with little thought of prevention of infection. In a 10-month period, June 1955-March 1956, 61 of 169 (36 per cent) dog stool specimens examined at the Hawaiian Medical Laboratory, without regard to age or clinical condition of the dog, were found positive for some intestinal parasite.[7]

It seems entirely probable that some unexplained neurologic disorders in children are caused by these infections. It has not been determined with certainty that mild infections in nonallergic individuals produce the typical clinical picture as in the case reported. Certainly in the past larval granulomatosis has not always been differentiated from familial eosinophilia, eosinophilic leukemia, Loeffler's syndrome, retinoblastoma and endophthalmitis. The finding of an eosinophilia greater than 20 per cent and a history of eating dirt should suggest the diagnosis. Other symptoms relative to the respiratory tract, central nervous system, and an enlarged liver and spleen further support the diagnosis. A liver biopsy showing granulomas along with the clinical picture, would appear to furnish a presumptive diagnosis, although the specific etiologic diagnosis can only be made by identification of the larva. The small size of the parasite and the few sections usually made from a biopsy specimen make the finding of the parasite unlikely. Complete sectioning of the specimen in a heavy infection, as in the reported case, increases the likelihood of identification.

SUMMARY

A two-year-old boy with a history of eating dirt was found to have an enlarged liver and spleen, white blood cell count of 48,000 per μl (65 per cent of which were eosinophils), and a total serum protein of 9.48 grams per 100 ml (33.8 per cent of which was gamma-globulin). A liver needle biopsy revealed many granulomas and several larvae identified as *Toxocara canis*. It is believed that liver needle biopsy is a safe method of proving the diagnosis of larval granulomatosis.

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Acute Pulmonary Edema During Intermittent Positive Pressure Breathing

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A PATIENT at this hospital developed acute pulmonary edema during an intermittent positive pressure breathing (IPPB) treatment. This report discusses the possible causes of the emergency in relation to the known alterations in ventilatory and cardiocirculatory function under IPPB, and reviews the dynamics of mechanical respiration by means of pressure alterations.

The experience gained in applying these principles to disease states, and the methods available, are reflected in the references cited.

CASE REPORT

A 54-year-old man, well known to the medical staff, came to the chest clinic on 28 March 1956 for a scheduled treatment with IPPB. He had had frequent hospitalizations, had been retired from military service at this hospital by reason of disability, was seen regularly in the chest clinic, and had been on IPPB treatment for a prolonged time.

Past History. He had a prolonged history of respiratory disease dating from 1938, when he had his first bout of pneumonia. Following this he had repeated bouts of respiratory infections, which cleared with difficulty. The course of his disease then became characterized by progressive shortness of breath, especially marked after exertion; cough, sputum production, bouts of so-called asthma, and easy fatigability. He had been smoking two packs of cigarettes daily for many years and was advised to stop smoking. Hypertension was noted and he was placed on symptomatic therapy.

In April of 1954 he was hospitalized for severe dyspnea. Treatment was provided for his chronic pulmonary disease and hypertensive cardiovascular disease. An electrocardiogram revealed changes compatible with right ventricular enlargement. Congestive heart failure was suspected but not diagnosed. He denied orthopnea, paroxysmal nocturnal dyspnea, and ankle swelling. He was discharged from the hospital in June 1954, but stated that his exertional dyspnea was worse.

From Fitzsimons Army Hospital, Denver, Colo.

He was given 0.25 mg of Serpasil (brand of reserpine) four times a day for his hypertensive disease. Diastolic blood pressure was consistently over 100 mm Hg and systolic ranged from 140 to 180 mm Hg.

On 20 January 1955 he experienced an acute onset of severe dyspnea described as a choking sensation. Unable to sleep lying flat, he resorted to sitting upright in a chair. He had increased cough and produced a frothy sputum. In the hospital he was found to have acute congestive heart failure with pulmonary edema. He was treated for this condition and responded favorably to digitalization, low-sodium diet, bed rest, and oxygen by tent as needed. His blood pressure returned to 140/80 mm Hg. The impression was that he had cor pulmonale possibly secondary to multiple pulmonary emboli and/or severe obstructive emphysema.

In June 1955 he was retired from military service because of disability due to pulmonary emphysema with cor pulmonale and hypertensive cardiovascular disease. Positive physical findings at this time were limited to the chest, where coarse rhonchi were heard over both lung fields along with fine crepitant rales. Vocal and tactile fremitus were decreased. The percussion note was hyperresonant over both lungs. Chest expansion was markedly diminished bilaterally, and the anteroposterior diameter was increased. The heart was enlarged. Heart sounds were distant, being best heard beneath the xiphoid process, and P_2 was increased over A_2. Electrocardiogram revealed a semivertical position with straightening of the S-T segment in aVf. There was moderate clockwise rotation of the heart and flattening of the T waves in all precordial leads. Roentgenograms of the chest back to 1952 revealed an emphysematous chest with a somewhat prominent hilar area. Pulmonary function studies demonstrated a severe air-flow obstruction characteristic of obstructive emphysema (table 1). He was on maintenance digitoxin 0.1 gm daily and nebulized Isuprel (brand of isoproterenol).

TABLE 1. *Pulmonary function studies showing severe air-flow obstruction compatible with obstructive pulmonary emphysema. (Arterial oxygen saturation, at rest, 95 per cent; with exercise, 90 per cent)*

Test	Observed performance	Predicted normal	Per cent of predicted normal
Maximum breathing capacity	34.4 l/min	125 l/min	36
Vital capacity	2.0 liters	4.1 liters	49
1-sec vital capacity	1.0 liters or 60%	73-75%	
Air velocity index	0.74	0.90-1.10	

Present Illness. On 28 March 1956 the patient came to the chest clinic for his scheduled treatment with IPPB. Medication included 6 drops

of Isuprel, 1:200 solution, in 5 ml of Alevaire nebulized with compressed air under a positive inspiratory pressure around 18 cm H_2O. Expiration was allowed to take place passively. Prior to the start of this treatment he appeared his usual self, exhibiting the usual labored breathing but with no suggestion of critical respiratory impairment. He seemed composed and free of any manifest anxiety or apprehension.

After 4 to 5 minutes of treatment, a critical change in his status was obvious. He became severely dyspneic, experienced a sensation of suffocation, and had to withdraw from the face mask. He appeared cyanotic. A wild, frightened, apprehensive expression was evident. There was no complaint of chest or precordial pain. He was coherent. He remarked that the treatment was not helping him as it usually did. After a pause of a minute or two he appeared to improve, so the face mask was replaced and the procedure was continued. After a period of 1 to 2 minutes he removed the face mask again because of increasing dyspnea. His anterior thorax was now markedly elevated and appeared to be "trapped" in an advanced inspiratory position. He was deeply cyanotic and gasped desperately for air. His face was again distorted by a wild, frightened stare. His respirations were shallow with evident use of the accessory muscles. His lips were pursed during expiration. The radial pulse rate was 160, weak and difficult to elicit. His blood pressure was 110/60 mm Hg (one hour later on the ward, blood pressure had risen to 160/90). The cervical veins were greatly distended in the sitting position. Heart sounds were distant. Cardiac rhythm was regular. Abundant moist rales and expiratory wheezes were heard throughout both lung fields. He had 3 plus pedal edema. The liver was easily palpable below the costal margin.

The patient was taken to the ward where the following measures were instituted: oxygen by tent, extremity tourniquets, aminophylline intravenously, Dicumarol (brand of bishydroxycoumarin), mecurial diuretics, and increased amounts of digitalis. Over the next several hours he improved rapidly. Since that time he has been maintained on low sodium diet, mercurial diuretics as required, digoxin 0.5 mg daily, expectorants, and pneumodilators.

DISCUSSION

The explosive onset of this complication had to be explained by a pathophysiologic process capable of producing an abrupt alteration in ventilatory and/or cardiocirculatory function. The diagnoses considered were: (1) acute cardiac arrhythmia, (2) acute myocardial infarction, (3) acute massive pulmonary embolism, or (4) acute alterations in respiratory pressure dynamics adversely affecting ventilation and circulation. Cardiac arrhythmia and myocardial infarction were ruled out by appropriate clinical observations and electrocardiograms. The diagnosis of massive pulmonary embolism was not too satisfactory because

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of the absence of many major criteria: (1) complete absence of any type chest pain, (2) no acute electrocardiographic changes, (3) no roentgenographic changes compatible with pulmonary infarction or acute pneumonitis, (4) absence of hemoptysis, (5) absence of a febrile episode, (6) absence of pleural effusion, (7) absence of overt phlebitis, (8) absence of jaundice, and (9) absence of shock or collapse.

Previous studies have proved that pulmonary embolism may occur without infarction,[1-3] but I believe that an embolus of almost any size at that time would have produced infarction. The patient's long-standing obstructive emphysema, cor pulmonale, and hypertensive cardiovascular disease, provided abnormal pulmonary circulation and congestion, which are ideal prerequisites for infarction following embolism. The work of Chapman and associates[1] supports this point. In addition there are theoretical considerations relative to circulatory dynamics under IPPB which argue against the assumption proposed by some that this form of mechanical respiration, by increasing velocity of circulation, would stimulate release of embolic showers from already established venous thrombi factories. The fact that clinical and laboratory findings in pulmonary embolism may be extremely varied or nonspecific is appreciated by the author through personal experience and a review of pertinent literature.[1,2,4,5] However, when a diagnosis lacks the support of many major criteria, as listed above, a curiosity persists about other possibilities.

IPPB is handled in this clinic with consideration as to both its hazards and benefits. Patients scheduled for treatment with IPPB are surveyed for indications and contraindications. Specific details for treatment are prescribed by a physician, and supervision is maintained throughout the procedure. The potential adverse effects of using IPPB in the presence of congestive heart failure, shock, or circulatory collapse is appreciated. In these latter cases, increase in intrapulmonary pressure may retard entrance of blood into the right side of the heart. However, the explosive rapidity with which this complication occurred could not be satisfactorily explained either by past experience or through knowledge of any similar case reported in the literature.

A vast reservoir of information in the literature about mechanical respiration was reviewed.[6-16] The basic ventilatory and cardiocirculatory dynamics of positive pressure respiration were well documented, and the experience gained in applying these principles in normal and abnormal cardiopulmonary states was adequately recorded. The application of this information to our

problem gradually produced, in logical sequence, an association of ideas and facts heretofore scattered and unrelated.

Once the mechanisms were organized into a logical sequence of events, the end result was analyzed in terms of three variables that were present simultaneously so as to provide vector forces acting in additive fashion to give an explosive resultant. The three variables believed to be responsible for the patient's complication on IPPB are:

1. The presence of severe obstructive pulmonary emphysema.

2. The use of positive inspiratory pressure alone, at a high level (18 cm H_2O), allowing a passive expiratory phase.

3. The presence of marked cardiocirculatory abnormality manifested by cor pulmonale and hypertensive cardiovascular disease requiring appropriate therapy.

SEVERE OBSTRUCTIVE PULMONARY EMPHYSEMA

In normal breathing, the respiratory muscles change the shape of the thorax. As the thorax is actively expanded, an increasingly negative interpleural pressure is produced. An associated reduction of pressure in the alveolar space occurs, producing a pressure gradient (transpulmonic pressure) in the tracheobronchial tree. In the presence of unobstructed air channels, air flow proceeds almost to completion during the inspiratory phase of the cycle.[17,18] This allows air flow into the lungs until alveolar pressure approaches atmosphere pressure, or peak mask pressure in IPPB. Because the alveolar ventilation volume will parallel pressure change, the approximation of mask and alveolar pressure will assure that the alveoli do not change shape more than volume. Expiration then proceeds to completion, the exhaled volume equals the inhaled volume, and respiratory pressure dynamics remain normal.

In the presence of airway obstruction, resistance to air flow prevents the alveolar spaces from filling to mask pressure,[17,18] and the normal sequence of events is altered by the slowing of air flow. The respiratory muscles effect a change in the shape of the thorax, thereby producing an increasingly negative interpleural pressure. The negative interpleural pressure in turn reduces the pressure in the alveoli. This latter situation causes a change in shape of the alveoli that is in the nature of a ballooning or distention. Because the resistance to air flow prevents the alveolar pressure from approximating the peak mask pressure, the volume ventilating the alveoli is less than the change in shape. With the stimulus from high level positive pressure inflating the airway, voluntary hyperventilation can occur,

as was the case in this patient. This greatly aggravates the sequences outlined above, whereby an increasingly negative interpleural pressure and alveolar distention are produced.

Because the emphysematous patient is further handicapped by altered elastic properties of the lung and thorax, a vicious cycle of disproportion between alveolar distension and alveolar emptying is established. The consequences of this are as follows:[19]

1. Expiration does not proceed to completion; the volume of air exhaled is not equal to the volume inhaled, and air trapping results.

2. Inspiration starts from a progressively higher point on the lung volume scale (hyperinflation) with each respiration.

3. A process of increasing functional residual volume takes place, resulting in further impaired alveolar ventilation and hypoxia. As a consequence of the latter, increased capillary permeability ensues.

4. In addition, an increasingly negative interpleural pressure occurs, providing a "suction-like" action on the pulmonary capillaries. This results in increased capillary permeability conducive to edema formation.

Now, to account for the explosive nature of this complication, one must understand how the above outlined sequence of events was intensely aggravated by voluntary hyperventilation. High-level positive pressure inflating of the airway, in the presence of significant bronchiolar obstruction, can provide a stimulus invoking a stress response (hyperventilation) similar to that noted in emphysematous patients performing a maximum breathing capacity. Not infrequently we have to caution and instruct patients about overbreathing during IPPB. In patients with obstructive emphysema, a gross change in thoracic configuration with fixation at a high inspiratory level has been noted. This adverse process of overdistention will continue until either the obstruction is relieved or sufficient elastic recoil presents in the overstretched lungs to expel in the time available an amount equal to the inspired volume.

The importance of a prolonged expiratory phase in patients with emphysema, as it relates to the production of positive pressure against the pulmonary capillary, has been stressed by Barach and associates.[6] The prolonged expiration of the patient with bronchospasm results in an increased positive pressure between the site of bronchial constriction and alveolar capillaries. When, however, an acutely elevated negative pressure is introduced within the chest, there is an abrupt termination of

expiratory effort and a consequent loss of the backward pressure on the pulmonary capillaries. As this occurs, the pulmonary capillaries become immediately more permeable. These authors also reviewed the dynamics involved in the production of pulmonary edema following induced tracheal stenosis. Their experiment illustrates how increases in the negative intrapleural pressure, by exerting a suction action on the pulmonary capillaries, increases pulmonary capillary permeability, congestion, and edema formation. This latter condition affects the relationships between the forces of hydrostatic pressure, osmotic pressure, and tissue turgor which operate to maintain the homeostasis of capillary permeability.

Paine and co-workers[20] have demonstrated that abnormal fluid exchange in the lung tissue may result from disturbances of hydrostatic and osmotic pressure relationships as described by Starling;[21] they conclude that Starling's principles apply to the pulmonary as well as to the systemic circulations, and must be considered in all future studies relating to the pathogenesis of pulmonary edema.

In applying this basic information to the problem, a sequence of mechanisms was established which explained the occurrence of edema. Let me re-emphasize that this adverse effect of creating a high negative intrathoracic pressure while inflating the airway under positive pressure relates specifically to the presence of an obstructed air flow. In the presence of an unobstructed airway, and normal forces of elasticity and compliance of the lung and thorax, this complication would not be expected. Let us now consider the second variable which added to the dilemma as an additive vector force in the production of the resultant.

HIGH LEVEL POSITIVE INSPIRATORY PRESSURE ALLOWING A PASSIVE EXPIRATORY PHASE

In speaking of mechanical respiration, the type used must be specified. In particular, it is not enough to speak only of "positive pressure" treatment of pulmonary edema. The type used may be of paramount importance to result-and-ventilatory and cardiocirculatory dynamics in the individual patient. The question as to which is the best mechanical method of artificial respiration is still unsettled. Much of the confusion has resulted from the practice of evaluating methods and machines on persons in a normal physiologic state rather than on patients in circulatory and/or respiratory failure. A basic classification of mechanical respiration includes three types:[11,14]

1. Intermittent positive pressure. Administered as positive, inspiratory pressure, allowing expiration to occur passively or

to be carried out against positive pressure. Through acquired use, however, IPPB has become identified with the singular use of positive inspiratory pressure.

2. Alternating positive-negative pressure in cyclic fashion during inspiration and expiration respectively.

3. Continuous positive pressure throughout both phases of the respiratory cycle.

In this patient a high level of pressure (18 cm H_2O) was used. Expiration was allowed to occur passively. In the presence of the severe bronchospasm present at the time, we may assume that the adverse effect of increasing negative intrathoracic pressure resulted. This appeared to be manifested clinically in the patient's thoracic position of advanced inspiration, indicating air trapping. If a negative or positive pressure expiratory phase had been provided, this complication might have been prevented.

It is now readily apparent that the first two variables are related. The one was important only through the simultaneous presence of the other.

IPPB IN THE PRESENCE OF CARDIOCIRCULATORY AND/OR RESPIRATORY ABNORMALITY

Numerous studies have been conducted evaluating the use of positive intermittent pressure. In normal persons no significant adverse physiologic changes in cardiopulmonary dynamics have been recorded. This has been documented using all available varieties of machines and pressure alterations.[14] The production of adverse physiologic effects with positive pressure inflation of airways was regularly noted in patients suffering from respiratory and/or circulatory failure. The results in this latter group were in distinct contrast to those in normal persons. The following adverse effects, especially when pressure is in excess of 8 cm H_2O was applied, were recorded:

1. A fall in systemic blood pressure.

2. A decrease in cardiac output. This reaches levels of 41.9 per cent in some severely disabled patients.

3. Increased systemic venous pressure. This reached levels of 70 per cent in patients in failure.

4. Prolongation of circulation time.

5. Reduction in blood volume.

6. Elevation of cerebrospinal fluid pressure.

Studies by Maloney and co-workers[14] suggested a good correlation between the circulatory effects and the mean mask pressure.

They demonstrated that these adverse effects were regularly eliminated by machines employing a negative phase during expiration. Introducing a negative expiratory phase avoided the circulatory depression, improved systemic blood flow, and permitted patients to maintain blood pressure and cardiac output at normal levels.

Our patient was unquestionably in very poor respiratory and cardiocirculatory status. This was well established in his protracted history of pulmonary emphysema, cor pulmonale, and hypertensive cardiovascular disease. It may have been that progressive deterioration of his cardiocirculatory status was the most important variable of those discussed, even though by itself (without high level IPPB) it could not have produced the explosive emergency which occurred.

By integrating these facts we can understand how the simultaneous presence of certain mechanisms, acting in the manner of additive vector forces, produced an alteration in function. The resultant explosive formation of pulmonary edema represented a summation of many forces. This took place even though by standard classification the treatment method was indicated for the disease state. The lessons or recommendations that might be drawn from this experience are:

1. Mechanical respiration is an excellent therapeutic tool but demands an understanding of methods, machines, and physiologic effects in treating respiratory and/or cardiocirculatory problems.

2. It is especially important to find out whether the air channels are obstructed or unobstructed, and whether the cardiocirculatory status is normal or to some degree abnormal.

3. Positive pressure breathing assistance in the treatment of pulmonary edema must be individualized as to type and pressure level.

4. Alteration in function is effected through the additive (cumulative) action of multiple vector forces producing a given resultant.

SUMMARY

A case of acute pulmonary edema occurring during positive pressure inflation of the air channels is presented. The attending ward physicians thought that this resulted from a massive pulmonary embolism. In the absence of many major diagnostic criteria, a different explanation was sought. Analysis based upon physiologic principles that have been known for years seems to support the contention that this complication was the resultant of multiple vector forces acting simultaneously in an additive manner. In the final analysis the condition must be recognized as a complication of intermittent positive pressure breathing.

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Total Pancreatectomy for Chronic Relapsing Pancreatitis and Calcinosis of the Pancreas

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TOTAL pancreatectomy has been shown to be a practical procedure in the treatment of certain types of pancreatic disorders, including some cases of carcinoma of the pancreas, islet-cell adenoma, and chronic relapsing pancreatitis with or without calcification.[1] Although the technical difficulties of the procedure have been satisfactorily overcome, physiologic problems have been produced, some of which are incompletely understood. Some 40 cases of total pancreatectomy have been recorded in the literature and from these has been gleaned valuable information concerning the metabolic changes which are produced together with their method of management. However, as Waugh and associates[1] pointed out, many patients, young and old, must be observed and studied before final conclusions can be reached concerning the character of diabetic and other changes in these patients. We wish to report another case of successful total pancreatectomy and to discuss some of the metabolic changes noted during a 12-month follow-up.

CASE REPORT

A 33-year-old Negro was first admitted to this hospital on 10 February 1951 for orthopedic treatment of wounds of the right wrist received in Korea. During the period of treatment he developed episodes of "acute gastritis" associated with nausea, vomiting, and epigastric pain. These attacks were mild in nature, responded to conservative therapy, and were usually associated with ingestion of alcohol. Serum amylase, urinalyses, and two gastro-intestinal roentgenographic studies were reported as normal. Following discharge from service, the patient had repeated similar episodes which did not require hospitalization. In February 1954 the patient was seen in a Veterans Administration outpatient clinic where glycosuria was found and a diagnosis of diabetes made. The condition was mild and easily controlled by diet alone.

On 8 April 1954 the patient was rehospitalized at this hospital because of right upper quadrant and epigastric pain with radiation to

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the back of two days' duration. There was no associated nausea, vomiting, hematemesis, or icterus. He also gave a history of a 30-pound weight loss and increased frequency of urination during the 6 months prior to admission. His attacks of pain had become so severe, disabling, and of such frequency that he was no longer able to hold a job. Past history revealed a moderate intake of alcohol for several years. There was no family history of diabetes or other significant illness.

Physical examination showed a thin man in acute distress. His height was 5 feet 7 inches; weight, 118 pounds; temperature, 98.6; pulse rate, 74 per minute; and blood pressure, 118/74 mm Hg. Significant findings were limited to the abdomen. There was no distention or rigidity, but definite tenderness to palpation in the epigastrium and right upper quadrant with voluntary guarding was noted. No organs or masses were felt, and peristalsis was normal. The remainder of examination revealed normal findings except for healed scars of the right wrist and hip. Routine laboratory studies and urine sugar were normal. Serum amylase determinations on three occasions over a six-day period were all within normal range. A gastro-intestinal roentgenographic study showed no intrinsic disease but revealed heavy calcification in the region of the pancreas (fig. 1).The gallbladder was barely visible on a cholecystogram.

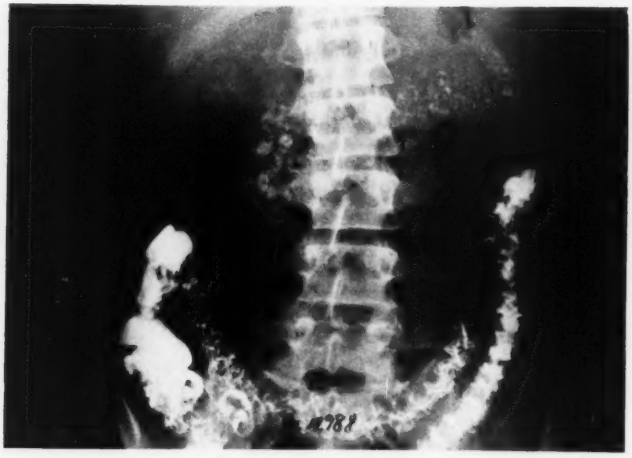

Figure 1. Heavy diffuse calcification of the pancreas throughout its entire extent.

On 22 April the patient was taken to surgery where the pancreas was exposed following division of the gastrocolic omentum. The organ was found to be hard, nodular, and pale with marked edema of the surrounding tissues. The spleen was removed because a severe and extensive fibrous reaction made it technically impossible to identify

and spare the splenic vein. When the lateral and diaphragmatic attachments of the spleen had been divided, together with the vessels to the greater curvature of the stomach, it was possible to move the spleen anteriorly and thus carry out the posterior dissection more simply. The splenic vein was ligated at its junction with the mesenteric vein to form the portal vein, and the splenic artery was ligated at the celiac axis. The pancreatic ducts were exposed and ligated. Dissection of the pancreas from the portal vein was extremely difficult because of dense adherence. The common duct could not be located even when the lateral attachments of the duodenum had been divided, nor could it be identified even when the duodenum had been opened and a rigid probe had been passed up the duct through the papilla. Consequently, the pancreas was "carved" off of the medial aspect of the duodenum, leaving a rim of fibrous tissue around the probe when it eventually could be palpated. The blood supply to the duodenum was not disturbed, so that no interruption of the gastro-intestinal tract was necessary. The entire pancreas was then mobilized and beneath the head a small pseudocyst was found. Pancreas, cyst, and spleen were removed *en bloc* (figs. 2-4). A T-tube was placed in the common duct and the abdomen was closed, bringing the T-tube out through a lateral stab wound for external drainage as a precautionary pressure vent.

Figure 2. The tail of the pancreas is densely fused to the hilum of the spleen, which showed passive hyperemia in microscopic section. The normal appearance of pancreas is lost, there being no apparent lobulation, and the small pseudocyst is seen in the region of the uncinate process.

The postoperative course was entirely smooth with neither biliary, duodenal, nor pancreatic leak. The patient had one episode of hypoglycemia on the first day, and was maintained on intravenous fluids and regular insulin, the latter not exceeding 25 units per day. By the third postoperative day the patient was given a 2,000-calorie diet and varying amounts of regular insulin, averaging 24 to 36 units daily. On the tenth postoperative day the T-tube was clamped for several hours and the patient did not experience any pain or discomfort. Therefore the tube was

left clamped, and when a cholangiogram two days later showed normal sphincter function and common duct emptying, the T-tube was removed without incident or sequelae. On 13 May the patient was placed on

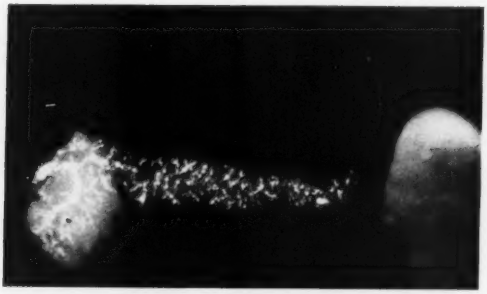

Figure 3. Roentgen examination of the excised specimen demonstrates the diffuse calcification which follows the course of the duct.

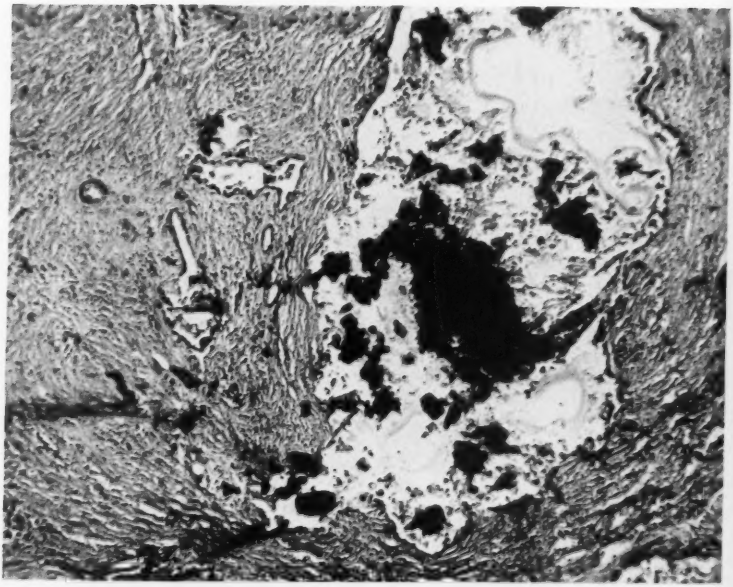

Figure 4. Photomicrograph of the pancreas showing diffuse heavy fibrosis with loss of definitive pancreatic tissue. An area of calcification is clearly shown.

30 units of protamine zinc insulin, which was changed to neutral protamine Hagedorn (NPH) insulin on 7 June, good control being maintained throughout. The remainder of the hospital stay was uneventful except for some right upper quadrant pain following meals.

The patient was discharged from the hospital on 25 units of NPH insulin, a 2,000-calorie low-fat diet, and no pancreatin.

The patient was followed in the diabetic and gastroenterology clinics. He did well but added fats to the diet and developed crampy abdominal pain, abdominal distention, and began passing two to four bulky, foul-smelling stools per day. He was placed on 3 grams of pancreatin and noted some improvement although he continued to have abdominal distention, especially in the mornings. Although fairly good control of the diabetes was maintained, the insulin requirement gradually and progressively increased (fig. 5).

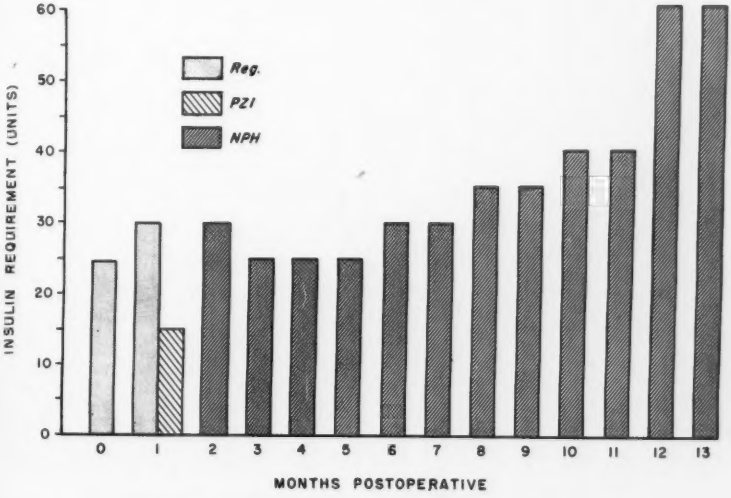

Figure 5. Patient's postoperative insulin requirement.

On 7 April 1955 the patient felt ill, and had a 4 plus urine sugar and a blood glucose of 626 mg per 100 ml. He was admitted to the gastroenterology service for further evaluation. Physical examination showed no marked changes from the previous admission except for the presence of marked abdominal distention. The diabetes was brought under control by gradually increasing the NPH insulin to 60 units; pancreatin dosage was increased to 6 grams per day. Laboratory studies obtained during the hospitalization were as follows: admission hemogram, normal; urinalysis showed 4 plus sugar; blood glucose, 342 mg per 100 ml; blood urea nitrogen, 23 mg per 100 ml; basal metabolic rate on three occasions, minus 2, minus 13, plus 15. Liver function studies showed: sulfobromophthalein sodium retention, 2 per cent; bilirubin, 1.2 mg per 100 ml; prothrombin time, 14 seconds (normal 15 seconds); alkaline phosphatase, 10.5 units, cephalin-cholesterol flocculation 4 plus in 24 hours and 4 plus in 48 hours;

and thymol turbidity, 10.4 units. Cephalin-cholesterol flocculation and thymol turbidity determinations were done as part of the routine liver studies (although strictly speaking, their inclusion among liver function tests may be questioned) and because they showed abnormal levels, liver biopsy was performed. The specimen showed only minimal histologic change with radiating cords of typical polygonal cells with well-defined borders and oval to round nuclei with uniform staining quality, but with some variation in size and with vacuolation of many nuclei; the portal triads showed a few infiltrating lymphocytes and an occasional polymorphonuclear cell. There was no evidence of fatty infiltration (fig. 6). We were unable to explain the abnormal values of the cephalin flocculation and thymol turbidity. Roentgenograms of the skull were normal.

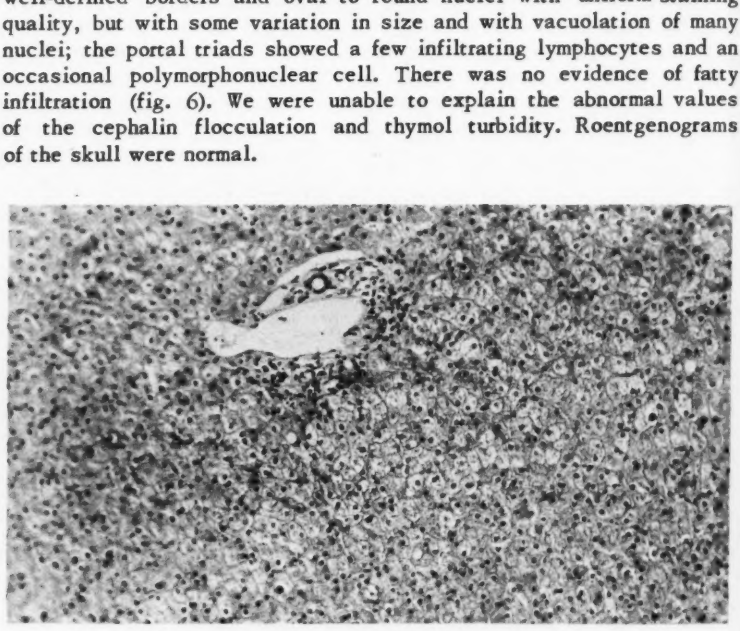

Figure 6. Photomicrograph of liver biopsy specimen.

During hospitalization the patient showed rapid improvement, the diabetes was well-controled, and the abdominal distention almost completely disappeared. After discharge the patient was again followed in the clinic, and has done well to date. Caloric intake, as far as possible, was maintained between 2,200 and 2,400 calories. There was a gradual but progressive gain in weight from an immediate postoperative level of 118 pounds to 127 pounds 14 months later.

DISCUSSION

Severe organic tissue change in the pancreas indicates that medical management alone will not give the patient sufficient relief. It was thought that the physiologic damage in the pancreas of this patient (as evidenced by development of diabetes) and the structural damage (as demonstrated roentgenographically by the heavy, diffuse calcification) required operative intervention. Operative treatment is limited to attempts at promoting more

effective drainage, ablation of pain, or removal of degenerated tissue. Promotion of drainage by sphincterotomy or anastomosis of the tail of the pancreas to the bowel to allow retrograde drainage did not seem indicated, for although there was diffuse calcification along the duct system, there were no stool changes indicative of a lack of external pancreatic secretion. Ablation of pain by splanchnicectomy is not always successful and has the disadvantage of failing to attack the site of tissue change. We prefer a direct attack rather than simply rendering retained abnormal tissue less painful. For these reasons excision was decided upon and because the diabetes and diffuse calcification both indicated extensive diffuse damage, total pancreatectomy was thought to be the only chance for an acceptable end result. Formerly, it was believed that total pancreatectomy would so impair duodenal blood supply that duodenectomy was mandatory. This meant that the Whipple procedure with its disruption of continuity of the gastro-intestinal and biliary tracts was necessary. We now know that total pancreatectomy can be accomplished without sacrifice of the duodenum and without necessarily entering the common duct. This permits total removal of diseased tissue by means of a much less radical procedure. Finally, we do not accept the philosophy that all lesser procedures should be tried and proved as failures before the final radical procedure is justified. This would mean subjecting the patient to at least three major operations, which seems too much to require.

In most cases, the insulin requirement following total pancreatectomy has been noted to be relatively low and insulin sensitivity increased.[2–4] Because of this, it has been suggested that in the immediate postoperative period, control of ketosis, rather than the blood sugar level, should be the primary aim. When diabetes exists prior to the time of surgical intervention, the severity of the disease shows more variation. Dixon and associates[5] reported a case in which diabetes, present for four years prior to surgical intervention, remained at about the same severity postoperatively. Pincus and Rutman[6] noted that some patients who had been diabetic previously actually required smaller amounts of insulin after operation. Our patient has shown a progressive *increase* in the amount of insulin required for satisfactory control.

The nature of the increased insulin sensitivity has been discussed by many authors and several mechanisms have been suggested, including poor nutritional status,[1] disturbances of digestion and absorption,[7] and elimination of the activity of a pancreatic insulin antagonist following operation. It has since been shown that this latter substance is glucagon and is probably derived from the alpha cells of the pancreas. Its function is to raise blood glucose levels by producing glucose from hepatic glycogen.[6] That this substance is actually an adjunct,

rather than an insulin antagonist, was substantiated by Van Itallie, Morgan, and Dottie[6] who showed that peripheral utilization of glucose was enhanced by glucagon. That the absence of such a hyperglycemic agent might be responsible, in part, for the milder diabetes would seem reasonable.

All patients who have had a total pancreatectomy show some impairment of digestion and absorption of fats and protein.[5] Our study did not include stool analysis for fats, but clinically the patient manifested fat intolerance as shown by abdominal distention, discomfort after a fatty meal, and several bulky stools per day. These symptoms were well controlled by the administration of 6 grams of pancreatin per day, which is in keeping with the suggestion by Fallis and Szilagyi[2] that from 6 to 8 grams is usually sufficient.

In experimental work with dogs, Dragstedt[3] demonstrated the development of fatty livers following total pancreatectomy. This could be prevented by the administration of raw pancreas. He believed that this effect was not due to pancreatic enzymes, lecithin, or choline, but to a specific substance called lipocaic, thought to be an internal secretion of the pancreas. Beneficial effects of pancreatin were attributed to presence of lipocaic as well as pancreatic enzymes in this substance. Later studies[2] showed that a lipotropic pancreatic substance either is not required for lipid metabolism in the human being or, if it is required, is supplied in sufficient amounts in the average diet. Honjo and Araki[7] reported that the absorption of fats following total pancreatectomy was better in humans than that noted in dogs and concluded that man retains a better capacity for absorption after surgery than does the dog.

SUMMARY

Severe organic tissue change in the pancreas of patients with chronic relapsing pancreatitis indicates that medical management alone will not be adequate treatment. Physiologic damage, as evidenced by diabetes or fat intolerance, and structural damage, as evidenced by calcification of the pancreas, require operative treatment. Total pancreatectomy, which can now be accomplished without sacrifice of the duodenum, permits total removal of the diseased tissue. We do not accept the philosophy that all lesser procedures should be tried and proved as failures before total pancreatectomy is justified.

In the case reported, total pancreatectomy for chronic relapsing pancreatitis and calcification of the pancreas was performed. Postoperatively, the patient's diabetes showed a progressive decrease in insulin sensitivity, in contrast to the increased sensitivity usually noted. Although no chemical determinations of fat metabolism were made, postoperatively the fat tolerance was greatly improved clinically by the daily administration of

6 grams of pancreatin. Liver function studies showed slight abberation after operation. A needle biopsy of the liver was performed to rule out fatty infiltration, which has been observed in dogs and suggested as occurring in man. No significant histologic abnormalities were noted. To our knowledge, this is the first reported histologic study of the liver following total pancreatectomy.

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Transverse Aberrant Testicular Maldescent

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TESTICULAR anomalies of position have been classified as undescended and descended.[1] An undescended testicle may be obstructed in its normal anatomic course by mechanical or hormonal factors, in which case it is considered cryptorchid. If it lodges outside of its normal pathway, it is ectopic. Anomalies of the descended testicle are inversion, in which the testicle is upside down, and retroversion, in which the posterior surface of the testicle is anterior. Both of the latter conditions are very rare.

The ectopic testicle may be (a) interstitial or inguinal, in which the testicle lies anterior to the aponeurosis of the external oblique muscle; (b) femoral (crural), in which the testicle lies in Scarpa's triangle; (c) pubopenile; (d) perineal; or (e) transverse aberrant. In the last condition, both testes descend through the same inguinal canal to the same scrotal sac. Fourteen cases of this anomaly have been reported in the literature. In 1910, Corner[2] observed a 14-year-old boy whose left testicle was found within a congenital right hernia. In 1916, Hertzler[3] found both testes and an infantile uterus in the same scrotal cavity of a pseudohermaphrodite. In a case recently reported by Lowsley and Kirwin[4] a 30-year-old man had absence of the left testicle from the scrotum, bilateral hernias, and perineal hypospadias. During left hernioplasty no testicle was found. During right hernioplasty a small aberrant testicle without an epididymis was found suspended by means of a small vas from the middle of the inguinal portion of the normal right vas. The aberrant testicle contained a malignant dysgerminoma. Lowsley and Porras[5] stated that this anomaly is frequently associated with congenital inguinal hernia, less often hypospadias, and presence of a small infantile uterus within the scrotal sac.

CASE REPORT

A 26-year-old man was admitted to this hospital with a chief complaint of swelling and pain in the right groin of one-month duration. The patient stated that this began while he was carrying lumber. He had felt something give on the right side of his abdomen near the groin, and thereafter noted a bulge into the right scrotum. He

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was able to replace this bulge into the abdomen. Pain in the groin was accentuated by coughing and straining. There was no history of gastrointestinal or genitourinary disturbances.

Past History. The patient stated that he had had no serious illnesses. At age six he fell and injured his left scrotal area. He denied being treated by a physician and he was not hospitalized for this injury. As long as the patient could remember, he had had only one scrotal testicle.

Family History. The patient was married and had two children. All were in good health and the children had no congenital anomalies. There was no history of anomalous development in the patient's parents,

Physical Examination. Physical examination revealed a well-developed, somewhat obese, man in good health. The ears, nose, and throat were normal. Heart and lungs were normal. The abdomen was moderately protuberant with no palpable masses. Examination of the genitalia revealed a normal penis, normal right scrotal testicle, and a complete right indirect inguinal hernia. The left external inguinal ring was narrow, and a slight impulse was transmitted to the examining finger when the patient coughed. There was no evidence of hernia on this side. A 2-inch, well-healed, contracted scar was noted in the left scrotal tissue laterally. There was questionable underdevelopment of the left scrotal tissue. No testicle or cord structures were palpable in the left scrotum.

Laboratory Findings. The serologic test for syphilis and results of a urinalysis were negative. Hemoglobin was 16 grams per 100 ml. The white blood cell count was 8,000 per μl. A roentgenogram of the chest was normal.

Course in Hospital. On 31 January 1957, under general anesthesia, exploration of the right inguinal canal was performed. Inspection of the cord structures revealed a congenital indirect hernia, the sac extending around the right testicle. Proximally the hernial sac was mobilized and dissected away from the cord up to the internal ring. Visualization of the opened sac at this point revealed a sliding component. Mobilization of this component revealed a testicle and associated cord structures, including epididymis and vas deferens. This testicle was one-third the size of the scrotal testicle, soft, and separated from its epididymis. Palpation of the mesorchium and the cord structures of this atrophic testicle suggested that they emanated from the left extraperitoneal space. There was no evidence of adhesions or scar tissue surrounding the testicle or cord structures, which might have suggested that this testicle had luxated from the left following the known episode of trauma. The cord of this aberrant testicle could be mobilized easily through the right internal ring. It could be brought down the right inguinal canal easily. Because of their atrophic appearance, the aberrant testicle and cord structures were resected. The internal ring was then closed following high

ligation and resection of the hernial sac at its neck. A Bassini type hernioplasty was performed. The postoperative course was uneventful. A postoperative intravenous pyelogram revealed no other evidence of urinary tract anomalies. Microscopic study of the aberrant testicle revealed it to be atrophic; there was no evidence of neoplasia in this testicle.

DISCUSSION

In fetal development the gonads form just below the diaphragm. A more rapid elongation of the trunk cephalad, in contrast to the slower growing gonad, produces a relative shift of the gonad to a more caudal position. At 10 weeks the caudal end of the gonad lies at the boundary of the abdomen and pelvis, close to the groin.[6] At 12 weeks a sac-like protrusion of peritoneum, the vaginal process, evaginates through the ventral abdominal wall producing a short inguinal canal, and at the 7th month passes over the pubis into the scrotum. In doing this, muscular and fascial layers of the abdominal wall are also carried down and added to what becomes a scrotal sac. After the 6th month, the testis normally descends along this same path. The testis follows the gubernaculum along the inguinal canal. The ductus deferens, spermatic vessels, and nerves are carried into the scrotum along with the testis and epididymis.

The cause of testicular descent is still unknown. The role of the gubernaculum is disputed. It has been thought that at the seventh month the gubernaculum stopped in its growth and shortened, thereby drawing the testicle into the scrotum. Others say the gubernaculum is too loosely attached to the testis to do this. In experimental animals, even though the gubernaculum was severed, normal descent of the testicle occurred in the majority of cases.[4] Evidence suggests that hormonal factors are probably the chief cause of descent.

The cause of abnormal descent also is unknown, but the following anatomic factors either singly, or in combination, may predispose to testicular maldescent: (1) an unusually long testicular mesentery which allows the gland undue intra-abdominal freedom and renders engagement in the internal ring less likely; (2) mesorchial peritoneal adhesions; (3) abnormal persistence of the plica vascularis which may anchor the testis high; (4) short spermatic vessels or vas deferens; (5) testicular fusion; (6) absent, unusually long, or inactive gubernaculum; (7) maldevelopment of the inguinal canal—either relative or absolute atresia; (8) cremasteric hyperactivity interfering with descent; (9) scrotal maldevelopment or absence of a testicular cavity.

The role of the gubernaculum may be only to guide or make a pathway for the descent of the testis. In rats, when the crural

nerve was severed prior to eight days of age, failure of testicular descent occurred isolaterally.[7]

In the case reported, the testicle was completely separated from the epididymis. This is a frequent anomaly in the presence of ectopia testis, and is due to failure of urogenital union at the sixth week of development. Congenital hernia associated with ectopia is also a frequent occurrence. It is theorized that in this patient, descent to the opposite internal ring was caused either by aberrant gubernacular attachment and/or a defective left internal ring. It is interesting to note that in dissection of the three-month embryo, the testes are in close approximation in their descent, being no more than several millimeters apart.[8]

Operation is the treatment of choice in ectopic testes in order to either replace the testis in the scrotum if possible, or to remove the testis if it is atrophic. Studies have demonstrated a fairly high incidence of neoplasia in ectopic testes. The danger of torsion is also present in a freely movable intra-abdominal testicle. Marked separation of the testis and epididymis is also a predisposing factor for torsion of the spermatic cord. Hormone therapy is valueless. The optimum period of time for orchiopexy is up to age eight.

Following demonstration of testicular anomalies it is important to investigate the possibility of other anomalies of the genitourinary and other systems. In our patient, no other anomalies were apparent.

SUMMARY

Transverse aberrant testicular maldescent is a form of testicular ectopia. Fourteen cases of this condition. in which both testes descended through the same inguinal canal to the same scrotal sac, have been reported in the literature. This anomaly is frequently associated with congenital inguinal hernia and less often with hypospadias.

In the case reported, transverse aberrant testicular maldescent was associated with a congenital hernia and separation of the testicle and epididymis. It is postulated that in this patient, maldescent of the left testicle to the opposite internal ring was caused either by aberrant gubernacular attachments and/or a defective left internal ring.

Three factors make operative intervention the treatment of choice for ectopic testes: (1) the high incidence of neoplasia in ectopic testes; (2) the danger of torsion of the spermatic cord in a freely movable intra-abdominal testicle, or when there there is marked separation of the testis and epididymis; and (3) the ineffectiveness of hormone therapy. The testis may be replaced in the scrotum if possible, or removed if it is atrophic. The optimum period of time for orchiopexy is up to age eight.

It is important to look for other congenital anomalies when this testicular developmental abnormality is discovered.

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ALDOSTERONISM VS. PRIMARY RENAL DISEASE

The distinction between primary renal and primary adrenal potassium loss is a matter of great moment, for in Conn's syndrome [aldosteronism] removal of the adrenal tumour may bring about complete cure, while in primary potassium-losing renal disease potassium supplements are the only useful treatment and complete renal failure is the expected outcome. Conn's syndrome is to be suspected when there is no history of a primary renal disease, when very large potassium supplements fail to lead to the improvements expected, and when renal biopsy shows only the tubular lesions of potassium depletion without evidence of other renal disease. If there are signs of an adrenal tumour, and if it is possible to demonstrate excessive amounts of aldosterone in the blood or urine, the diagnosis becomes easier; but if doubts cannot be resolved exploration of the adrenals may be justified.

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Multiple Subcutaneous Granular-Cell Myoblastoma

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JAMES H. LOCKWOOD, *Captain, MC, USN*

GRANULAR-CELL myoblastoma is generally considered to be a relatively rare benign tumor, most often occurring as a solitary lesion involving the tongue. The next most common site of occurrence is the subcutaneous tissue,[1] in which there is usually an intimate association of the tumor with the overlying epidermis. This association is characteristically represented by pseudoepitheliomatous hyperplasia,[2] which could be interpreted as squamous cell carcinoma. The tumor usually appears in the third, fourth, or fifth decade. Recently Cave, Kopf, and Vegas[3] reported three cases of multiple myoblastomas occurring in children whose ages were 4, 6, and 8 years. The sexes are equally affected.

Granular-cell myoblastoma was recognized as a clinical and pathologic entity after the original publication by Abrikossoff[4] in 1926, who was of the opinion that striated muscle was chiefly implicated in the histogenesis of this tumor. Since that time there have been others who have, by tedious morphologic and histochemical studies, come to the conclusion that granular cell myoblastoma is of neural origin.[2,5,6]

Malignant granular-cell myoblastoma has been reported[7-10] but its incidence, as the literature indicates, is extremely rare. Malignant granular-cell myoblastoma arising in the urinary bladder with subsequent widespread metastases and death was reported by Ravich, Stout, and Ravich.[7] Ross, Miller, and Foote[10] reported three cases of malignant granular-cell myoblastoma. They were of the opinion that the reported frequency of occurrence of this tumor in a malignant form has been exaggerated by the inclusion of other types of myosarcomas.

The occurrence of multiple, subcutaneous, benign, granular-cell myoblastoma nodules is rare, the incidence being about 2.5 per cent in a total of less than 250 cases reported up to the present time.[1,3,6,11-14]

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the muscle tends to have elongated blunt-ended nuclei, while the nuclei of the alleged nerve fibers are sharply pointed."

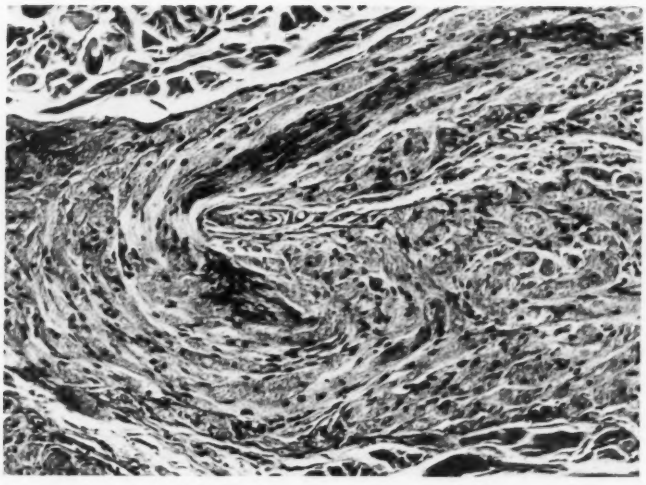

Figure 1. Myoblastoma cells surrounding or in close association with a neural structure. (Hematoxylin-eosin stain, × 145)

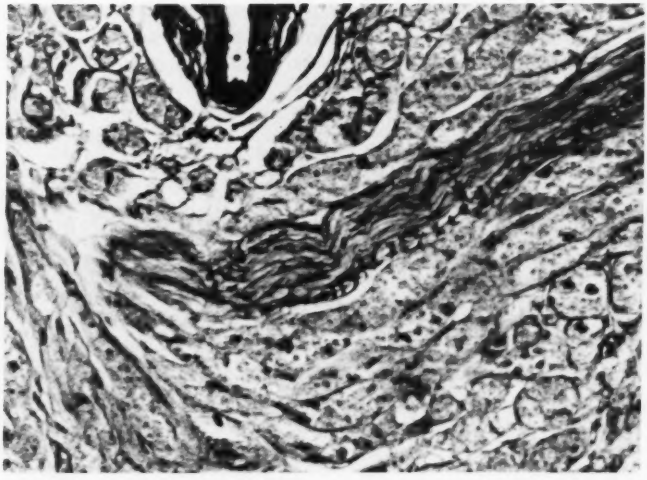

Figure 2. Higher magnification of an area similar to that shown in figure 1. Note the peculiar vacuolated appearing cells containing granules which are in close association with a neural structure. (Mallory stain, × 280)

CASE REPORT

A 23-year-old white man was well until the spring of 1952 when he first noted a small, nontender, subcutaneous nodule on the ventral aspect of his right forearm. During the following 15 months he developed multiple 7- to 12-mm moderately firm, subcutaneous nodules on the neck, face, chest, both arms, buttocks, and legs. Some of these tumors seemed to be attached to the overlying skin. The nodules were not painful but there was some tenderness when moderate pressure was applied. He had no systemic complaints. His past history and family history were essentially negative. The general physical examination was normal except for the findings as stated above.

The laboratory work was reported as follows: white blood cell count, 7,200 per μl with a differential count of 48 per cent neutrophils and 52 per cent lymphocytes; red blood cell count, 5,560,000 per μl; hemoglobin, 15.5 grams per 100 ml; hematocrit, 54 ml per 100 ml. The urine was normal. The blood Kahn test was negative. The total serum protein was 7.1 grams per 100 ml; albumin 4.9 and globulin 2.2 grams per 100 ml. A roentgenogram of the chest was reported negative. A complete skeletal survey failed to demonstrate any definite roentgenographic evidence of disease of the bones.

Pathologist's Report

The histopathologic report from the pathology service of this hospital on an excised specimen was as follows: "The sections show skin with multiple circumscribed nodules in the dermis. The latter are composed of large polyhedral cells with a coarse, pink, granular cytoplasm and small, round, hyperchromatic nuclei. The cells are regular in size, shape, and staining reaction. No mitoses or giant nuclei are seen. There is a definite relationship between the nodules and peripheral nerves [figs. 1 and 2]. At least one of the nodules shows the presence of nerve fibrils in the center of the nodule. Several of the other nodules show nerve sheath cells along the periphery. There is no evidence of malignancy. Acid-fast stains of the tissue are negative. Diagnosis: Granular-cell myoblastoma."

From a second excised specimen, Dr. Harlan L. Papenfuss, of Lincoln, Nebr. (formerly on active duty as a pathologist at this hospital), made a series of specially stained slides for study. In reference to the hematoxylin-eosin type stained sections he stated in part:

"In all of the slides within some of these masses [of granular cells] and near their central point, one notes a small bundle of varying length of rather closely packed, narrow, spindle-shaped cells all running in a uniform direction [fig. 3]. In a few areas, these bundles of cells seem to be near the periphery of the nodule as if they are penetrating the mass of cells. It is these bundles that I feel are the nerve bundles of nerve fibers. Note that they differ in character from the smooth muscle of the arrectores pilorum muscles. With hematoxylin-eosin type staining the contrast is not too great, yet the arrectores pilorum muscles appear to have more cytoplasm and less nuclei. Similarly,

Masson's trichrome and a reticulum stain aided little. However, azocarmine stain revealed that the bundles of fibers under discussion stained bluish rather than red orange as did the arrectores pilorum and were, therefore, not muscle. A Weil's stain for myelin sheaths showed a blue-black staining of some of the fibers of these bundles, which was interpreted as evidence of myelin and, therefore, of neural origin.[15]

This set of slides was presented to Dr. Hamilton Montgomery, Section of Dermatology, the Mayo Clinic, for study and comment. Both he and his associate, Dr. R. K. Winkelmann, were impressed by the evidence of nerve involvement, but with reservations. Dr. Winkelmann, who has done considerable study in regard to cutaneous nerve endings, stated that although the close correlation between the granular-cell

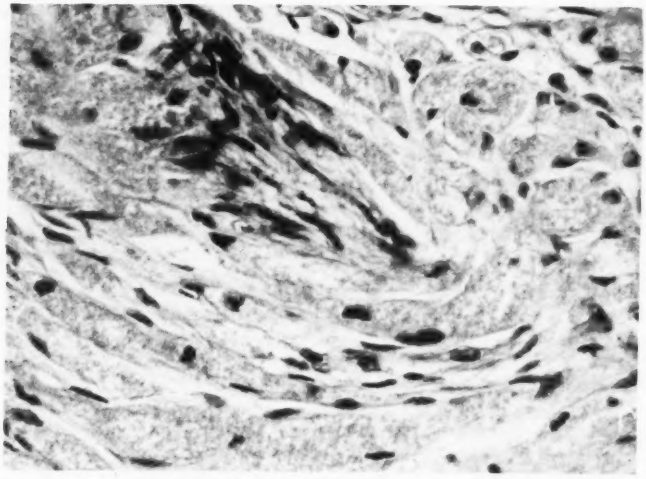

Figure 3. Another high-power view showing myoblastoma cells with what appears to be part of a neural structure. (Hematoxylin-eosin stain, × 420)

myoblastoma cell masses and nerves was the strongest evidence he had yet seen of the neural origin of this tumor, nevertheless, the nerves themselves appeared normal and had the tumor arisen in nerve that structure should have been destroyed early. Dr. Montgomery[16] was of the same opinion, as was Dr. J. Kernohan of the Mayo Clinic, who reported that the tumor appeared to arise from the perineural tissue rather than from the nerve itself.

During hospitalization the patient developed additional lesions, the newer ones occurring on the back of the neck, forearms, and sides of the fingers. A second biopsy specimen of a lesion distant from the first was reported as essentially the same. At the time of discharge

from the hospital the patient had developed a total of 46 cutaneous and subcutaneous nodules.

It was decided to treat one typical subcutaneous nodule with roentgen irradiation. The lesion treated was located on the right, upper, anterior part of the chest and was exposed to a total of 1856 r., delivered in 4 exposures over a period of 9 days. At the time of hospital discharge, 7 weeks later, the treated lesion had undergone no appreciable change. Myoblastoma has been reported by others[3] as being radioresistant.

SUMMARY AND CONCLUSIONS

Granular-cell myoblastoma is an uncommon lesion usually located in the tongue. Occurring as multiple subcutaneous nodules it is exceedingly rare and would seldom be considered in a differential diagnosis.

The case of a young adult male with multiple, granular-cell myoblastoma nodules is reported. At the time of discharge from the hospital, the patient had developed a total of 46 cutaneous and subcutaneous lesions. The histopathologic findings in this case were typical myoblastoma cells with granular cytoplasm. There was a distinct, definite, and consistent relationship of these nodular groups of myoblastoma cells to neural and/or perineural elements. There was no suggestion of malignant change, and this patient was otherwise in good health.

All laboratory studies, including bone surveys, were within normal limits. One lesion that was treated by roentgen irradiation proved to be radioresistant, again demonstrating the radioresistance of these tumors. The treatment of choice appears to be surgical excision of individual lesions.

Although there appears to be evidence, on the basis of histopathologic study of two lesions in this case, of the possible origin of these tumors from neural or perineural elements, the true origin still remains elusive. It will require further study, both histopathologic and histochemical, to solve the mystery of origin as well as the nature of the material contained within the granular cells.

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Porencephaly

THEODORE H. WILSON, Jr., *Commander, MC, USN*

THE TERM "porencephaly" is controversial. For the purpose of this discussion it means a defect in cerebral or cerebellar structure that appears as a cyst-like cavity. The defect communicates with the ventricles or the subarachnoid space, or, separated from the ventricles by a thin layer of brain tissue, it is covered on the outside by pia-arachnoid and filled with a clear, often colorless fluid.

There are many theories of etiology, and considerable literature dealing with the pathology of this lesion. That such cyst-like structures could be of either congenital or acquired origin is apparent. Whether a partial agenesis, a vascular occlusion to some portion of fetal brain, intrauterine trauma of some sort, or intrauterine infection can cause porencephaly is speculative. It is believed that birth trauma, subsequent trauma, or severe infections in the brain may produce the condition.

Relatively little has been published concerning the clinical recognition and treatment of porencephaly. Frequently, it is not diagnosed during life, either because there are no symptoms or because the symptoms are attributed to other conditions. The incidental finding of porencephaly at autopsy is not rare. These cystic structures have also been discovered quite unexpectedly during operation or air studies for suspected brain tumors.[1]

An epileptic seizure is the symptom that most often causes a patient with porencephaly to seek a physician's aid. The seizure may be Jacksonian or generalized. Mental retardation, motor weakness, speech defects, visual disturbances, or headache may be other presenting complaints. Symptoms generally are related to the location of the cyst, but the cyst may be huge and yet cause only minimal symptoms.

Findings on physical examination and routine roentgenography of the skull may be entirely normal. Occasionally examination will reveal motor deficits, speech defects, visual disturbances, asymmetry of the skull, mental retardation, or other findings that help in the localization of the lesion. Sometimes roentgenograms

From U. S. Naval Hospital, Oakland, Calif.

of the skull show asymmetry of the facial skeleton, with atrophy or bony condensation on the affected side. Evidence of increased intracranial pressure is rare. Pineal shift, unexplained intracranial calcification, or erosion of posterior clinoids may suggest the necessity of further investigation.

An electroencephalogram may assist in lateralizing the lesion, but the diagnosis is made with an air study. The pneumoencephalogram may reveal the defect if there is ventricular or subarachnoid communication. A ventriculogram may show the cyst. Unusual cases have been reported in which a cystic cavity was entered unexpectedly by an exploring needle while searching for a suspected tumor mass.

There probably is not complete unanimity of opinion among neurologists and neurosurgeons as to the advisability of operative therapy of this condition in the first place, and as to the type of operation in the second. In a small series of cases, there would appear to have been benefit from operation. The procedure used varies and has included simple incision of the cyst, partial or complete unroofing, total excision when the cyst is surrounded by removable scar, and cystoventriculostomy with or without choroid coagulation.[2-4]

The rationale for doing these operations is hard to explain, but the observed results seem to justify operative therapy. Patients who had epilepsy have been relieved of their symptoms by operation, some for many years, some apparently permanently. It would appear that when porencephaly had developed at birth or soon after, operation did not produce as good results as when the lesion presumably developed in later life, thus permitting other areas of the brain to assume the function of the absent portion. Those unusual cases in which there is increased intracranial pressure are helped by operation; those with mental retardation may show no further deterioration or may even improve.

The following case report illustrates the fact that an individual with a large cerebral defect, presumably originating early in life, may attain a high level of performance and have no symptoms for many years. While this report throws no light on the etiology of such lesions and the follow-up is too short to be of any prognostic value, the necessity is demonstrated of a thorough study in all instances of convulsive seizures in an attempt to find a remediable lesion.

CASE REPORT

A 28-year-old naval aviator with 10 years of active duty involving actual control of aircraft was brought by his wife to this hospital be-

cause while sleeping he had moaned incessantly, perspired profusely, could not be roused for fully 15 minutes, and was then lethargic and nauseated. His wife thought the patient was having a "seizure," and the ambulance attendant described jerky motions of the patient's legs and rolling-back of his eyes. On admission the patient appeared confused and drowsy. He had no headache, and there was no evidence that he had bitten his tongue or had had involuntary micturition or defecation. His wife stated that he had had highly spiced food for supper and afterward had two "highballs," but had gone to bed feeling well.

Physical and neurologic examinations revealed no abnormal findings, and routine blood and urine tests were normal.

Further questioning, when the patient was more alert, disclosed that a week prior to admission he had had a boil in the right nostril lanced, and subsequently had had swelling of the right eyelids that required antibiotic medication. Repeated questioning disclosed no past history of head trauma. The patient's mother recalled no abnormalities of her pregnancy or delivery. There was no family history of epileptic seizures. Repeated physical examinations showed no abnormalities. The patient was left-handed.

Spinal fluid, obtained by lumbar puncture, was clear, contained no cells, and had a normal protein content. An electroencephalogram had an abnormal pattern, and photic stimulation produced a mild right frontal dysrhythmia with delta and theta activity. These findings, coupled with the history of a recent virulent infection in the right nostril, suggested the possibility of a silent, frontal lobe abscess. A pneumoencephalogram on 16 November 1956 disclosed moderate enlargement but no displacement of both lateral ventricles and the third ventricle. The anterior horn of the right lateral ventricle was blunted. Air was present in what appeared to be a cavity lying just anterior to the anterior horn of the right lateral ventricle and occupying the entire frontal lobe area from the coronal suture forward (fig. 1).

A right frontal craniotomy was done promptly. The bone over the lesion was very thin. The dura appeared normal, but beneath it lay a large cystic space filled with clear fluid. This cavity extended from the anterior horn of the right lateral ventricle to the orbital roof and the crista galli. The falx and medial face of the left frontal lobe could easily be seen. There was no identifiable brain tissue forward of the ventricle except for a thin rim of yellowish tissue that arched up over the posterior portion of the cavity, forming a partial roof. This was biopsied and proved to be brain tissue. The anterior cerebral artery, along with other vessels of uncertain identity, could be seen coursing unsupported through the cavity. Inasmuch as it appeared that the cavity communicated with the subarachnoid space, no further procedure was done, save to replace the bone flap and suture the scalp. A postoperative roentgenogram of the skull is shown in figure 2.

Figure 1. Pneumoencephalogram showing blunting of the anterior horn of the right lateral ventricle and air in a cavity in the right frontal lobe.

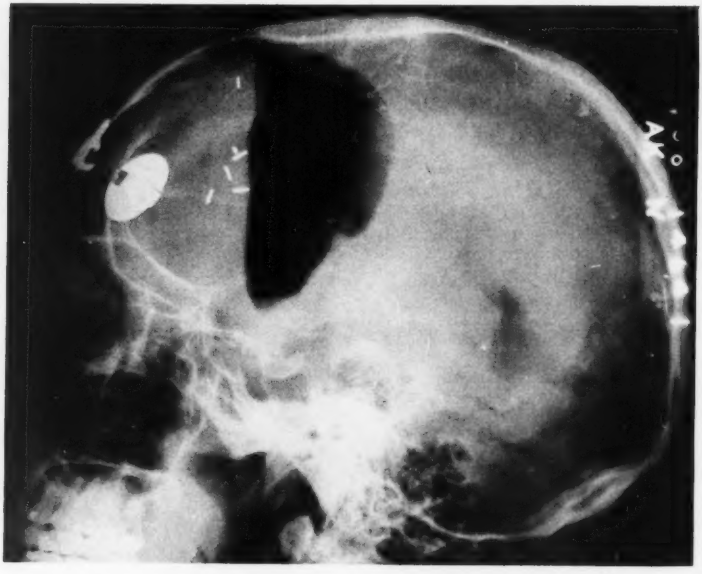

Figure 2. Residual air in the porencephalic cyst postoperatively.

Recovery was complicated only by two brief, generalized, convulsive seizures on the fifth postoperative night. The patient was treated with Dilantin Sodium (brand of diphenylhydantoin sodium) and phenobarbital. Recovery was rapid; he was subsequently discharged from the naval service, on medication, and has resumed academic training for a business career.

SUMMARY

Porencephaly frequently is first diagnosed at autopsy, or during air studies or operation for suspected brain tumor. This lesion often is not recognized because it may be asymptomatic or its symptoms may be attributed to other conditions.

Mental retardation, motor weakness, speech defects, visual disturbances, and headache may be produced by porencephaly. The patient seeks medical aid most often because of an epileptic seizure.

The findings on physical examination and routine roentgenograms of the skull may be entirely normal. The diagnosis is made by pneumoencephalography or ventriculography.

It appears that many patients with this defect are benefited by operation. The operative procedure used varies considerably.

A case report illustrates that a patient with a large porencephalic defect, presumably originating early in life, may attain a high level of performance and have no symptoms for many years. It also demonstrates the need for thorough study of patients with convulsive seizures.

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A MESSAGE FROM THE A. M. A.

The Education and Training Division, Office of the Surgeon General of the Army, recently reported on the pioneer efforts and subsequent impressive results of the Army Medical Service to prepare physicians and allied professional personnel to cope with mass casualties resulting from nuclear warfare. The program had an austere birth back in 1947 with a simple course and a few visual exhibits on the medical aspects of atomic explosions.

During the last 10 years, this program has rapidly developed to a point where it could be described as having "reached maturity." Today, military medical personnel at all levels are being taught essential lifesaving technics for treating casualties produced by modern weapon potentialities.

The Council on National Defense of the American Medical Association has been active for a number of years in acquainting the medical profession with its responsibilities for medical disaster preparedness. It is greatly encouraged by the excellent accomplishments in this field that have been made by the Army Medical Service. The Surgeon General, Major General Silas B. Hays, his staff, and all the other medical officers engaged in this program deserve the highest commendation for the splendid results being achieved. Civilian as well as military physicians are permitted to attend and participate in a number of the instructional courses. The Council takes this opportunity to acknowledge the military medical leadership directed toward the complex problems of management and care of mass casualties, and urges the continuation of these courses. The Council believes it appropriate to report on some of the activities in this field.

Courses in management of mass casualties have been given at Walter Reed Army Institute of Research in Washington, D. C., and the Army Medical Service School, Fort Sam Houston, Tex., and in the past year alone 795 professional personnel, military and civilian, have completed the 5½-day course. Traveling instructional teams have been sent to medical centers throughout

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From the Council on National Defense of the American Medical Association. The views and opinions expressed are not necessarily those of the Department of Defense. —*Editor*

the United States to stimulate interest on the part of the medical and paramedical public in the care of mass casualties.

One of the most far-reaching developments in the Army Medical Service's educational program in the past 12 months is the implementation of the new Army-wide, military tactical concept of having every soldier a first-aid man, if life is to be saved following a nuclear attack. Through a plan recommended by the Surgeon General of the Army, fully qualified Army Medical Service teams made up of officer and enlisted personnel are now giving basic individual first-aid instruction at all U. S. Army training centers in the United States.

Members of the teams are well-qualified trainers in first aid, and are chosen for their skill in teaching as well as for their medical knowledge. Plans have been made to train during 1957, 2,100 "medics," the traditional medical aidman of battle zones, in a 12-week course of concentrated and thorough instruction at the Army Medical Service School.

If the beneficial effect of so many young, future physicians receiving instruction in the care of mass casualties along with their study of technical medical topics is certain to be a national defense asset, the new first-aid training concept for the American soldier can have no less an impact on our population. The soldier will return to his home community with more knowledge of how to save his own life or that of his fellows than possessed by any nonmedical soldier since the United States Army was founded.

Eight Army Hospitals are conducting a course in acute trauma. This, in addition to providing continuous training for Army medical officers and commissioned ancillary personnel, is also open to civilian physicians and Reserve medical officers in their respective communities.

It is anticipated that this year special instructional material in the general care of mass casualties will be issued for Reserve units. The subject is regarded as a part of the over-all training in military medicine given to professional officers. Refresher courses that contain material on the medical aspects of nuclear weapons are now held for Reserve officers at the Army Medical Service School three times annually. In addition, spaces are allocated for Medical Corps reservists in the course on management of mass casualties.

While this instruction is the central point of the Army Medical Service educational program of preparation, many radii of allied information are being channeled to those who will work beside the physician. Nurses, dentists, veterinarians, and certain mem-

bers of the Medical Service Corps and the Army Medical Specialist Corps will render emergency and definitive medical care commensurate with their abilities. Clinical specialists, aidmen, and hospital corpsmen are being taught to carry a greater share of the professional and logistical load.

There is no substitute for preparation and hard work in any successful large-scale endeavor. This is particularly true for medical disaster preparedness. It is absolutely essential for civilian physicians to preplan and program their medical civil defense responsibilities. There is a wealth of practical application and valuable information to be gained by civilian medical groups from the experience of the Army Medical Service in the management and care of mass casualties following a nuclear attack upon this nation.

MEDICAL ORGANIZATION IN NUCLEAR WARFARE

"Successful offensive tactics in nuclear warfare depend on the development of small, mobile, self-sufficient tactical elements capable of rapid dispersion and regroupment. Successful defense similarly depends on the development of units that will not offer an easy target for a nuclear weapon; they must be flexible and mobile, yet linked by centralized control. The medical support, in particular, must include casualty-treatment units widely dispersed in each community and capable of operating for short periods with communications destroyed. All individuals therein must be trained in first aid for assistance to both themselves and others; organic medical support attached to tactical units must be as small as possible; all other supporting medical units must be mobile, widely dispersed, and centrally controlled; rapid transportation must be available. Individuals concerned with medical care must be available for transfer to and from distant areas, and they must be under some type of disciplinary control, the nature of which, whether civilian or military, should be decided before the emergency arises. Experience gained from a joint Army and Air Force maneuver in 1955 demonstrated these points, but the pattern can also be adapted by civilian communities to the problem of supplying medical care under disaster conditions."

—MAJOR S. WHITE, Brig. Gen., USAF (MC)
in *Journal of American Medical Association*
p. 959, Nov. 3, 1956

GROUND BROKEN FOR NEW AIR FORCE SCHOOL OF AVIATION MEDICINE

Ground was formally broken for the new headquarters of the School of Aviation Medicine at Brooks Air Force Base, San Antonio, Tex., on 10 May 1957. Founded in 1918 at Hazelhurst Field, Long Island, N. Y., the School of Aviation Medicine moved to Mitchel Field, Long Island, the same year. In 1926 it was moved to Brooks Field, Tex., and in 1931 to Randolph Field, Tex.

Major General Otis O. Benson, Jr., Commandant, School of Aviation Medicine, delivering the introductory address at ground-breaking ceremonies, Brooks Air Force Base, Tex., 10 May 1957. To the left is Lieutenant General Dean C. Strother, Commander, Air University.

This new aviation medicine research and teaching institution will consist of five modern functional buildings with a central heating and cooling plant. The Research Institute building will house the School headquarters, the Aeromedical Library, and more than 100 individual laboratories. The Academic Building will be able to accommodate over

700 students in six different courses, and will be equipped with closed-circuit color television. This educational television, linked with the Lackland Air Force Base Hospital, will enable students to see actual patients and medical technics without leaving their classrooms.

Symbolic ground breaking of new School of Aviation Medicine, Brooks Air Force Base, Tex., by the Honorable Paul J. Kilday, United States House of Representatives. Watching this ceremony are, left to right, Major General Dan C. Ogle, Surgeon General, U. S. Air Force, and Lieutenant General Dean C. Strother.

The Flight Medicine Laboratory will accommodate the consultation services and provide space for clinical research in aviation medicine. The Research Laboratory Shops will provide for instrument fabrication,

medical photography, and the electronic machines for processing research statistical data. The Altitude Laboratory will contain low-pressure chambers simulating the extreme altitudes required for research in support of tomorrow's aircraft.

During the five years spent in designing this establishment, specialists in every field of medicine, education, and research have been consulted to ensure that it will accommodate and adapt to the needs of the Air Force of tomorrow in the teaching, research, and practice of the specialty of aviation medicine.

Among those participating in the ceremony were the Honorable Paul J. Kilday, United States House of Representatives, who has given the project zealous support in Congress; Doctor Melvin A. Casberg, former Assistant Secretary of Defense (Health and Medical), representing the Department of Defense; Doctor Walter L. Bierring, Chairman of the American Board of Preventive Medicine; and Doctor Jan H. Tillisch, immediate past-President of the Aero Medical Association. The ceremonies were presided over by Major General Otis O. Benson, Jr., Commandant of the School of Aviation Medicine, while the principal address was given by Congressman Kilday, followed by symbolic ground breaking by Lieutenant General Dean C. Strother, Commander of the Air University; Major General Dan C. Ogle, Surgeon General of the U. S. Air Force; and Congressman Kilday. Other distinguished guests on the speakers' platform on this historic occasion were Lieutenant General John H. Collier, Commanding General, Fourth U. S. Army, Fort Sam Houston, Tex.; Mayor J. Edwin Kuykendall, of San Antonio; and Doctor James P. Hollers, President of the San Antonio Chamber of Commerce and former member of the Armed Forces Medical Policy Council.

Visiting military dignitaries from the Office of the Surgeon General of the Air Force included Major General Marvin E. Kennebeck, Assistant for Dental Services; Brigadier General Major S. White, Director of Medical Staffing and Education; and Brigadier General Victor A. Byrnes, Director of Professional Services; while the major air commands were represented by the following surgeons: Brigadier General Clyde L. Brothers, Air Training Command; Brigadier General Robert E. Lee, Tactical Air Command; Brigadier General Albert H. Schwichtenberg, Air Defense Command; and Brigadier General Edward J. Tracy, Air Materiel Command.

Among the distinguished Army officers attending the ceremonies from Fort Sam Houston were: Lieutenant General John H. Collier, Commanding General, Fourth U. S. Army; Major General Mark McClure, Deputy Commanding General, Fourth U. S. Army; Major General William E. Shambora, MC, Commanding General, Brooke Army Medical Center; Brigadier General Elbert DeCoursey, MC, Commandant, Army Medical Service School; and Brigadier General Dale B. Ridgely, DC, Director of Dental Activities, Brooke Army Medical Center.

Of the many officers of the Air Force Medical Service who have worked from the onset of this project, Colonel Frederick J. Frese, Jr., has been cited for his indefatigable activities during the past five years in directing the planning of the institution and co-ordinating the project activities with various congressional committees and other interested agencies in Washington.

FINDING THE ANSWERS IN AVIATION MEDICINE

One of the interesting aspects of aviation medicine is the manner in which it responds to the challenging problems arising in present flight operations, or to those created by considerations of future requirements. Frequently, solutions are based upon the fusion of bits of information, culled from many basic sciences and clinical subjects, having application to the human factors involved in aviation. However, where existing knowledge is meager or requires further extension, research and development projects are initiated to provide answers. What is perhaps unique in the wide field of medicine is that these answers must be correct, for upon them depend many lives and often tremendous economic investments.

—SIDNEY I. BRODY, Capt., MC, USN
in *Journal of Aviation Medicine*
p. 23, Feb. 1957

LEADERS IN MILITARY MEDICINE ATTEND RECEPTION FOR SECRETARY OF DEFENSE

A reception in honor of Secretary of Defense and Mrs. Charles E. Wilson was given by Assistant Secretary of Defense Frank B. Berry on Friday, 17 May 1957, at Fort McNair, Washington, D. C. The occasion afforded an opportunity for Secretary Wilson to meet in one group the eminent civilian advisers of the Department of Defense on medical and dental matters, and the leading administrators of military medicine and dentistry.

Reception line (left to right): Mrs. William H. Powell, Jr.; Major General William H. Powell, Jr., Deputy Surgeon General of the Air Force; Mrs. Bartholomew W. Hogan; Rear Admiral Bartholomew W. Hogan, Surgeon General of the Navy; Major General Silas B. Hays, Surgeon General of the Army; Mrs. Charles E. Wilson; Honorable Charles E. Wilson, Secretary of Defense; Dr. Frank B. Berry, Assistant Secretary of Defense.

Among the 350 who attended the reception were members of the Department of Defense Civilian Health and Medical Advisory Council, Dependents' Medical Care Advisory Committee, and Dental Advisory Committee. The Council members present were Dr. Melvin A. Casberg,

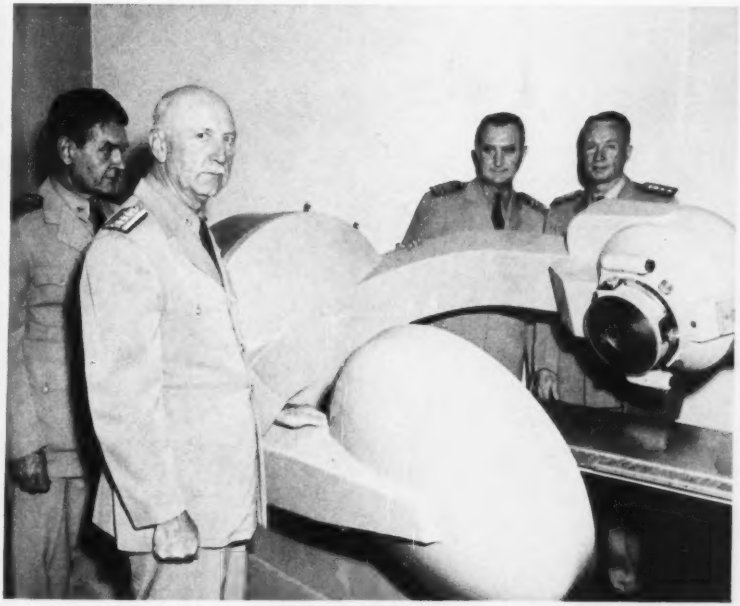
Austin, Tex.; Dr. Thomas P. Fox, Philadelphia, Pa.; Dr. Oscar P. Hampton, St. Louis, Mo.; Dr. James E. McCormack, New York, N. Y.; Dr. Anthony J. J. Rourke, New Rochelle, N. Y.; Dr. Wilburt C. Davison, Durham, N. C.; Dr. James P. Hollers, San Antonio, Tex.; Dr. Livingston Parsons, Jr., New York, N. Y.; and Dr. James L. Tullis, Boston, Mass.

The members of the Department of Defense Dependents' Medical Care Advisory Committee who attended were Dr. Edwin S. Hamilton, Kankakee, Ill., and Dr. Hugh H. Hussey, Jr., Washington, D. C., representing the American Medical Association; Dr. Harry Lyons, Richmond, Va., and Dr. William R. Alstadt, Little Rock, Ark., representing the American Dental Association; Dr. Albert W. Snoke, New Haven, Conn., representing the American Hospital Association; Dr. Paul R. Hawley, Chicago, Ill., and Dr. Arthur W. Allen, Boston, Mass., representing the American College of Surgeons; Dr. Wallace M. Yater, Washington, D. C., representing the American College of Physicians; Dr. Malcolm E. Phelps, El Reno, Okla., and Dr. Fount Richardson, Fayetteville, Ark., representing the American Academy of General Practice; Dr. Howard B. Hunt, Omaha, Nebr., and Dr. Warren W. Furey, Chicago, Ill., representing the American College of Radiology; Dr. Donald Stubbs, Washington, D. C., representing the Blue Shield; Mr. E. A. van Steenwyk, Philadelphia, Pa., representing the Blue Cross; Mr. Edwin A. Faulkner, Lincoln, Nebr., representing the Health Insurance Association of America; Mr. Steven D. Williams, Hartford, Conn., representing the health and accident insurance industry; and Dr. Dean A. Clark, General Director of the Massachusetts General Hospital, Boston, Mass.

The Department of Defense Dental Advisory Committee was represented by Dr. Thomas P. Fox (also a member of the Council); Dr. John C. Brauer, Chapel Hill, N. C.; Dr. Francis J. Reichmann, Oklahoma City, Okla.; Dr. William R. Alstadt (also a member of the Dependents' Medical Care Advisory Committee); Rear Admiral Ralph W. Malone, Assistant Chief for Dentistry, Bureau of Medicine and Surgery, Department of the Navy; Major General James M. Epperly, Chief, Dental Division, Office of the Surgeon General, Department of the Army; and Major General Marvin E. Kennebeck, Assistant for Dental Services, Office of the Surgeon General, Department of the Air Force.

COBALT IRRADIATOR IN CLINICAL USE AT NATIONAL NAVAL MEDICAL CENTER

On 17 May 1957 a new cobalt irradiation therapy unit was dedicated at the National Naval Medical Center, Bethesda, Md. It is the first cobalt irradiation to be placed in clinical use in the Armed Forces and is also the first one in the Washington area. A second unit is at present being installed in the new surgical suite of the U. S. Naval Hospital, San Diego, Calif.



Inspecting the new cobalt irradiation therapy unit are, left to right, Captain Edward C. Kenney, MC, USN; Rear Admiral Thomas F. Cooper, MC, USN; Captain S. F. Williams, MC, USN; and Rear Admiral Bruce E. Bradley, MC, USN.

The cobalt source in the Bethesda unit is of a strength of 500 curies. The unit is to be used in the therapy of selected patients with cancer, and will enable delivery of high irradiation dosage levels to deep-seated lesions. It is available by arrangement to all members of the Armed Forces and their dependents.

Participating in the ceremony were Rear Admiral Bruce E. Bradley, MC, Deputy Surgeon General, U. S. Navy, who accepted the unit for the Bureau of Medicine and Surgery; Rear Admiral Thomas F. Cooper, MC, USN, Commanding Officer, National Naval Medical Center; Captain Edward C. Kenney, MC, USN, Commanding Officer, U. S. Naval Hospital, Bethesda, Md.; and Captain S. F. Williams, MC, USN, Chief of Radiology, U. S. Naval Hospital, Bethesda, Md., who presided at the ceremony. Rear Admiral Charles F. Behrens, MC, USN (Ret.), the first Chief of Radiology at the Naval Medical Center in 1942 and later, Commanding Officer of the Naval Medical Research Institute, also attended the dedication.

NAVY PREVENTIVE MEDICINE UNIT COMMISSIONED AT NAPLES, ITALY

Preventive Medicine Unit Number Seven of the U. S. Navy was commissioned on 2 May 1957 at Naples, Italy, in ceremonies attended by high-ranking U. S. Army, Navy, and Air Force officers, NATO Southern Europe Commanders, and Italian health and government officals. Vice Admiral Charles R. Brown, USN, Commander, U. S. Sixth Fleet, sent a message of congratulations to the new unit.

Rear Admiral Bruce E. Bradley, MC, USN, lends a helping hand to Captain Joseph M. Coppoletta, MC, USN, as he cuts a cake marking the commissioning of the unit.

Speaking at the commissioning ceremony, Rear Admiral Bruce E. Bradley, Deputy Surgeon General, U. S. Navy, said: "The activation of this unit today is the result of a recent reorganization of Navy preventive medicine units throughout the world. These units are our frontline forces who fight germs and viruses, physical and chemical hazards, and other health problems affecting our military forces and their dependents all over the world." Admiral Bradley stated that the current policy of the Bureau of Medicine and Surgery is to have

Officers and hospital corpsmen of the new unit with Rear Admiral Bruce E. Bradley, Deputy Surgeon General, U. S. Navy.

its units keep pace with the Navy's modern and rapidly developing forces equipped with guided missiles and nuclear power. The units are equipped to render completely mobile preventive medicine services, and are ready to go on a moment's notice. The Deputy Surgeon General lauded the co-operation between the unit and Italian health officials in dealing with problems of mutual interest.

Captain Joseph M. Coppoletta, MC, USN, assumed duties as the Officer-in-Charge of the new unit. Explaining its purpose, he said: "Although our unit is based on land, the zone that is under our control goes from England to the Middle East. Our major customer will be the U. S. Sixth Fleet with her 25,000 men aboard 50 to 60 ships. It is for them and the thousands of their dependents that we are here; to make possible through conferences, films, and posters, the defense

of their health and the elimination of sources of possible infection." Captain Coppoletta and his staff of three Medical Service Corps officers and eight hospital corpsmen are ready at any sign of epidemic hazard to reach by air any zone of the coast, from the Atlantic to the Mediterranean, where American Military personnel are on duty, and any ship of the Sixth Fleet at sea or in port. Furthermore, the unit offers its services to the NATO forces, and is in daily contact with Italian health authorities for a constant exchange of views and programs.

DEATHS

HAMMERS, Benjamin Nicol, Lieutenant Colonel, MC, USAF, of West Newton, Pa.; stationed at the Office of The Surgeon General, USAF, Washington, D. C.; graduated in 1943, from Temple University School of Medicine, Philadelphia, Pa.; commissioned a First Lieutenant 5 January 1943; died 18 April 1957, age 39, of coronary thrombosis.

JOHNSON, Elmer Bernard, Captain, MC, USN, of Green River, Wyo.; stationed on the U. S. S. *Shangri-La* (CVA-38); graduated in 1938, from the University of Nebraska College of Medicine, Omaha, Nebr.; commissioned a Lieutenant (junior grade), in the U. S. Navy, 2 January 1941; died 28 April 1957, age 46, in the Pacific Ocean off the coast of Japan, the result of an aircraft accident.

FORMER EDITOR OF JOURNAL RECEIVES DECORATION

Colonel Robert J. Benford, USAF (MC), who was Associate Editor of this Journal from 1950 to 1953 and Editor from 1953 to 1955, recently received the Commendation Ribbon and Second Oak Leaf Cluster. The medal was presented by Major General Dan C. Ogle, Surgeon General of the Air Force, at a ceremony held in his office (see below).

The citation stated that Colonel Benford had distinguished himself while serving as a member of the Inter-service Committee for Dependents' Medical Care. After detailed studies of the problems involved, Colonel Benford made significant recommendations for providing medical care to service dependents in civilian facilities. These recommendations were largely responsible for the enactment of the Dependents' Medical Care Act.

OFFICERS CERTIFIED BY SPECIALTY BOARDS

Supplementary Listing

According to information from the Offices of the Surgeons General of the military medical services, the following regular Medical and Veterinary Corps officers have been certified by the boards indicated since the listings published in previous issues of this *Journal*.

American Board of Orthopaedic Surgery

Henry R. Ennis, Capt., USN
John J. Price, Jr., Comdr., USN

American Board of Internal Medicine

John J. Dempsey, Lt. Comdr., USN

American Board of Pathology

Albert Cannon, Lt. Comdr., USN

American Board of Surgery

William C. Adams, Jr., Lt. Comdr., USN
Robert F. Christoph, Capt., USN
John R. Palmer, Jr., Comdr., USN
Paul G. Richards, Capt., USN
William C. Trier, Lt. Comdr., USN
William R. Williams, Lt. Comdr., USN

American Board of Preventive Medicine

Founders Group in Occupational Medicine

Harry G. Beck, Capt., USN
William S. Francis, Capt., USN
Glenn D. Hutchinson, Capt., USN
Otto E. Van Der Aue, Capt., USN

American Board of Veterinary Public Health

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BOOKS

Reviews of Recent Books

UROLOGIC INJURIES IN GYNECOLOGY, Including Vesicovaginal Fistula, Stress Incontinence and Ureteral Injuries, by *Henry C. Falk,* M. D., F. A. C. S. A Series of Monographs, Obstetrics & Gynecology, edited by *Claude E. Heaton,* M. D. 285 pages; 97 illustrations. F. A. Davis Co., Philadelphia, Pa., 1957. Price $7.50.

This monograph on urologic injuries is in essence the etiology, prevention, and management of urinary incontinence in the female. It is divided into three sections: vesicovaginal fistula, stress incontinence, and ureteral injuries.

A brief history of vesicovaginal fistula with methods of repair are thoroughly described, and include vesical fistulas after cesarean section and loss of the urethra. Vaginal cystotomy is advocated over suprapubic cystotomy for diverting the urinary stream.

Full coverage is given to the medical and surgical treatment of stress incontinence. The author's surgical approach with amputation of the cervix or removal of the anterior cervical lip is explained in detail, as are the fascial transplant operations and the Marshall-Marchetti operation.

In the prevention of ureteral injuries the anatomy of the ureter and its relation to pelvic pathology are discussed with justifiable emphasis. Should ureteral injuries occur, their management is covered at the time of surgery and following the completion of the operative procedure.

In this volume Dr. Falk completely covers the problems of the gynecologist when confronted with urologic injuries in a readable, well-illustrated, and concise manner. He clearly defines policies, procedures, and technics which have proved successful for him and his group. This volume is a must for the gynecologist, of particular value to the urologist, and of interest to the general surgeon.

—*WILLIAM C. HERNQUIST, Lt. Col., USAF (MC)*

THE VISUAL FIELDS, A Textbook and Atlas of Clinical Perimetry, by *David O. Harrington,* A. B., M. D., F. A. C. S. 327 pages; 234 illustrations and 9 color plates. The C. V. Mosby Co., St. Louis, Mo., 1956. Price $16.

Occasionally, while reading through a new textbook, the conviction grows with each passing chapter that here indeed is a volume that will become a new teaching classic. There are a number of reasons for feeling that this text is one of those few. The writing is succinct and easily followed. There is maximal information and minimal verbosity.

The contents are divided into two parts. The first deals with the instruments and technics of perimetry, anatomic considerations, and the normal visual field. Each subject is completely covered. The chapter on the vascular supply of the visual pathway is a lucid condensation and that on special perimetric technics clarifies the extinction phenomenon and shows how it may be employed advantageously. Perimetry with ultraviolet radiation and luminescent test objects is developed in a way that is certain to advance interest in this technic.

Part two deals with the interpretation of defects in the visual field and provides a splendid text as well as a full atlas of perimetric diagnostic data. The author's rich background is clearly apparent. The illustrations, diagrams, and plates are excellent.

This book will surely become widely used as a text for students of neurology and ophthalmology, as well as an authoritative reference work.—*EDWARD A. HYNES, Capt., MC, USN*

THE PROBLEMS OF VISION IN FLIGHT AT HIGH ALTITUDE, AGARDograph No. 13, by *Thomas C. D. Whiteside*, Ph. D., M. B., Ch. B. Published for and on behalf of The Advisory Group for Aeronautical Research and Development, North Atlantic Treaty Organization, by Butterworths Scientific Publications, London. 162 pages; illustrated. Distributed by Interscience Publishers, Inc.. New York, N. Y., 1957. Price $5.

The author has written an excellent summary of the new visual problems we are experiencing in the recent years of high-altitude flight. He has accumulated the results of interviews with experienced pilots and has combined these with his own personal experiences at altitudes where most visual problems exist.

Measuring the accommodation of the eyes to determine "space myopia" has been done in a highly satisfactory manner. He has not only used subjective methods but has verified these findings with objective measurements of the accommodative state of the eye. He has shown that accommodative state of the eye. He has shown that accommodation is in constant activity, fluctuating about a level of 0.5 to 2.0 diopters. Because of this accommodation, subjects who were slightly hyperopic had better distant vision at high altitude. Space myopia occurs because of the empty visual field.

"Subjective haze" at high altitude was thought to be due to intraocular scatter or fluorescence. The author shows this is in error; the haze is due to a positive afterimage of the bright cloud floor combined with a low-grade anoxia which prolongs the afterimage. He points out the fact that sun glasses are comfortable but visibility is not as good. Using an antiglare visor is nearly as effective in combating veiling glare due to intraocular scatter and does not decrease vision.

This book is highly recommended for all flight surgeons and any one else concerned with visual problems at high altitudes.

—*JAMES L. FUELLING, Capt., MC, USN*

LIVER: STRUCTURE AND FUNCTION, by *Hans Popper*, M. D., Ph. D., and *Fenton Schaffner*, M. S., M. D. 777 pages; 204 illustrations. The Blakiston Div., McGraw-Hill Book Co., Inc., New York, N. Y., 1957. Price $20.

A great deal is known about the liver, its functions and its diseases, and there is a great body of writing on the subject. However, it is beyond the ability of most of us to sift out facts and tenable concepts which can be used in the understanding and treatment of patients with hepatic disease. The authors have done this for us, in a thorough, detailed and satisfying fashion. With a lifetime of experience in the field of liver disease the authors have produced a text which will make our approach to the patient more rational and knowledgeable, though possibly not more effective. They attempt to correlate the clinical and laboratory manifestations of liver disease with the morphologic changes in the liver. At present the correlation is far from satisfactory.

The book begins with a succinct description of the structure of the hepatic cell and of the metabolic processes which take place within it. There follows a discussion of the structure and function of the sinusoids, biliary system, blood vessels, lymphatics, nerves, stroma, and then of the whole organ. Having laid the firm foundation of the normal situation, consideration is given to the various pathophysiologic processes which may affect the hepatobiliary system.

The latter half of the book is devoted to description of the various liver diseases and to the effect on the liver of diseases of other body systems. Generous use of cross references permits elimination of repetitious description of previously described basic pathologic reactions. Liver tests and diagnostic methods are thoroughly discussed in a separate chapter. There is an appendix entitled, "Principles of Diagnosis of Liver Disease Based on Coordinated Use of Functional and Structural Observations."

The book is well printed, beautifully illustrated, and adequately bound. Two unusual features are very commendable: All of the 3,735 bibliographic references are assembled in a section at the end of the volume and arranged alphabetically, and there is a seven-page addendum summarizing work reported too late for inclusion in the body of the text. This is arranged by appropriate chapter headings, and the table of contents lists the addendum and page reference under each chapter where applicable.

This volume should be in the library of each hospital and of each pathologist and internist with special interest in liver disease.

—*BENJAMIN H. SULLIVAN, Jr., Col., MC, USA*

PHYSIOLOGIC PRINCIPLES OF SURGERY, edited by *Leo M. Zimmerman*, M. D., and *Rachmiel Levine*, M. D. 988 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1957. Price $15.

Doctors Zimmerman and Levine have done an excellent job of editing and co-ordinating the contributions of the 50 authors, thereby avoiding

repetition and wearisome historical verbiage. In this text has been combined much recent work previously available only in journals or monographs. It is an excellent reference text, contains chapters which every surgeon will want to read, and the specialized surgeon will enjoy that portion of the book pertaining to his particular field.

The chapters consider such broad topics as transplantation of tissues, blood transfusions, body fluids and electrolytes, pain and anesthesia, and then proceed to physiology as applied to congenital and acquired lesions of the various organ systems.

While the book is concerned primarily with clinical physiology, this is correlated throughout with embryology, clinical characteristics, laboratory aids, and treatment as required to make a co-ordinated presentation.

The type is legible, quality of paper is excellent, and the illustrations are clear. References appear at the end of each chapter and are voluminous.

This book is unique since it provides an authoritative reference source in the field of surgical physiology. It should be in every medical library and will probably become required reading for surgeons approaching examination for certification. —*DAVID E. THOMAS, Lt. Col., MC, USA*

CLINICAL USE OF RADIOISOTOPES. A Manual of Technique, edited by *Theodore Fields*, M. S., F. A. C. R. (Assoc.), and *Lindon Seed*, M. D. 17 contributors. 455 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1957. Price $9.50.

The editors have provided a book containing accepted technics being used in the field of clinical radioisotopes. The material is excellently presented.

The contributing authors are all well qualified in their field. Although they have selected for detailed description only those procedures which they consider to be most representative of the technics giving the most accurate results in their experience, a comprehensive bibliography is included at the end of each chapter. The editors are to be complimented on the excellence of the bibliographies which contain references, not only to the technics described in each chapter, but also refer to variations of these technics.

The order of presentation of the various isotopes and procedures used in clinical medicine affords a clear and concise understanding of the field. To complete their presentation, problems concerning requirements of the Atomic Energy Commission, facilities, personnel, equipment, and health physics have been considered in detail, and recommendations have been provided by scientists experienced in these areas. This section, frequently neglected in the literature, is of great value. The appendixes, including a glossary, statistical data, and record of report sheets, are also of great value.

This manual of technic should be of great value to the physician who uses radioisotopes clinically and should be of equal value to the administrators who are consulted concerning the setting up of radioisotope programs. It is a very worthwhile book for all professional people interested in this field. —*EDWARD A. LANGDON, Lt. Col., MC, USA*

HANDBOOK ON POLIOMEYLITIS, by *Joseph Treuta,* M. D., D. Sc. (Hon.) (Oxon.), F. R. C. S. (Hon.) (Canada), F. R. C. S.; A. B. Kinnier Wilson, M. A., M. B., M. R. C. P., D. P. M.; and Margaret Agerholm, M. A., B. M., B. Ch. (Oxon.). 139 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1956. Price $3.75.

There is a wealth of pertinent information in this little book that admirably suits the needs of the orthopedist and internist by outlining succinctly, for their nonprofessional ancillary help, many of the basic precepts that must be adhered to. The book adequately appraises the several views now held on the main problems related to the acute and chronic stages of poliomeylitis. It covers such things as the poliomeylitis viruses, their antibodies, epidemiology of poliomeylitis, factors precipitating frank disease, pathology, clinical description, management of the acute stage, respiratory complications, the transitional and recovery stage, and, finally, the management of permanent disability.

This makes an excellent and inexpensive reference work for all physicians and is good basic reading for medical students, physiotherapists, occupational therapists, and others interested in the subject. — *DAVID C. KELLSEY, Lt. Col., USAF (MC)*

CLINICAL DENTAL ROENTGENOLOGY, Technic and Interpretation, Including Roentgen Studies of the Child and the Adolescent, by *John Oppie McCall,* D. D. S., F. A. C. D., and *Samuel Stanley Wald,* D. D. S., F. A. C. D. 4th edition. 466 pages; 1,445 illustrations on 529 figures. W. B. Saunders Co., Philadelphia, Pa., 1957. Price $10.

In this fourth edition the authors have maintained the high standards of presentation evident in the previous editions. Several changes and additions have been incorporated, notably, a complete chapter on the long-cone technic; rearrangement of the chapters on standard technics for intraoral and extraoral films; a more complete coverage of the latest data concerning control, measurement, and effects of radiation; a more complete coverage of temporomandibular roentgenography; and complete studies of the child and the adolescent.

The increasing interest in the long-cone technic has brought about equipment changes, increasing the voltage to 90 kvp at 15 ma. The authors present a standardized technic in a thorough manner, with excellent photographs of patient and cone position and roentgenographic results obtained.

The section devoted to the production of roentgen radiation and the protective measures necessary gives a concise evaluation of the dangers imminent to all personnel involved in diagnostic and therapeutic

fields. New devices for the detection and measurement of roentgen radiation are adequately described and established limits of safety given.

The authors devote considerable attention to the important and often neglected diagnostic survey of the child. In this section a graphic discussion of the growth phenomena is presented. Such features as rarefaction in the mixed dentition are fully discussed and illustrated. Technics used in orthodontics and in temporomandibular articulation survey are emphasized.

The chapters on roentgenographic description of important pathologic changes and the location of impactions and foreign bodies round out a well-balanced and well-referenced text.

The appeal of this book is wide, encompassing all associated with diagnostic roentgenographic evaluation and is of particular value to those of the profession preparing for State and Specialty Board examinations.—*EDWARD R. HILDRETH, Jr., Capt., DC, USN*

PIONEER SURGEONS OF THE WOMAN'S HOSPITAL, The Lives of Sims, Emmet, Peaslee, and Thomas, by *James Pratt Marr,* M. D. 148 pages; illustrated. F. A. Davis Co., Philadelphia, Pa., 1957.

The Woman's Hospital opened in temporary quarters in New York City in 1855, and was chartered in 1857. This centennial volume offers brief lives of the four surgeons, James Marion Sims, Thomas Addis Emmet, Edmund Randolph Peaslee, and Theodore Gaillard Thomas, "whose integrity, intelligence and painstaking efforts made that institution the most potent factor in the development of modern American gynecology" in the judgment of the late Dr. James V. Ricci.

Dr. Marr devotes one section to each biographee. Each section is developed in such a manner that it might have stood alone, for in each the biographee is the focus while the other three colleagues are dimly seen. There is no final explication of the complex personal and professional relationships between all members of the quartet. The history of Woman's Hospital emerges in fragments from the four sketches. Some data is necessarily repeated in each section, but in general this problem has been skillfully handled. The story is an interesting one, and has been interestingly and straightforwardly told. One wishes that some of the major developments of the period, such as the lagging introduction of anesthesia and the advent of "Listerism," might have been more fully portrayed.

The book is replete with quotations from the writings of the four men and from other contemporary documents. It is a great vexation that none of these quotations have the source specifically identified. The short bibliographies at the end of each section are inconsistent in style and the entries are often inadequate to identify unequivocally the works cited.—*FRANK B. ROGERS, Lt. Col., MC, USA*

CORONARY HEART DISEASE, Angina Pectoris, Myocardial Infarction, by *Milton Plotz*, M. D., F. A. C. P. Foreword by *William Dock*, M. D. 353 pages; illustrated. Paul B. Hoeber, Inc., Medical Book Department of Harper & Brothers, New York, N. Y., 1957. Price $12.

In presenting a completely new text on the subject of arteriosclerotic heart disease, the author poses for himself a particularly difficult task. Notwithstanding, he has been successful to a remarkably effective degree.

The book is written to appeal to physicians of diverse professional backgrounds and varied primary interests, and there is a considerable amount of material that will not be of interest to all readers. At the same time, this necessary fault is minimized by a strict isolation of given topics within given chapters and a careful avoidance of repetition.

Many other considerations add to the effective presentation. The style of writing is clear and thoughts are presented in logical consequence. The current bibliography constitutes an excellent compendium of the classics on the subject which have been published in the last ten years. Of special interest is the correlation of presumed divergent concepts in the chapter on lipid metabolism. Clinical evaluation receives careful consideration as do the details of instrumental methods of supportive diagnosis. Medico-legal questions are included as well as the problems of impending infarction and prophylactic management. In general, there is no clinically important aspect of the subject which has not been accorded a fair and searching appraisal. The physical form of the volume similarly reflects good organization and attention to deserving detail.

For these few of many good reasons, this book is likely to be a much read and appreciated addition to most personal as well as larger medical libraries. —*ROBERT B. DICKERSON, Lt. Col., MC, USA*

RADICULAR SYNDROMES, With Emphasis on CHEST PAIN Simulating Coronary Disease, by *David Davis*, B. S., M. D. 266 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1957. Price $6.50.

This brief text describes many radicular syndromes involving primarily the cervical and upper thoracic spine which produce chest pain or other symptoms which simulate coronary artery disease. The material is presented in a brief, concise, orderly manner and is read with ease. The author describes in adequate detail the various etiologies, the characteristics and locations of the various types of root pain, the sensory and motor signs, the symptoms, and the roentgenologic findings seen in the various radicular syndromes. Methods of conducting many of the special examinations which will assist the reader in establishing an accurate diagnosis are described.

The illustrations used include black-and-white photographs; drawings and charts assist the reader in a better understanding of the material presented. The book is well edited in all respects and the format of the text is good. The bibliography is complete and current and is listed alphabetically by the author. The table of contents is adequate and the text is carefully indexed. The case reports are well selected and concisely presented, and these emphasize and illustrate the various syndromes described by the author.

This book will prove to be of considerable value to the medical student, the general practitioner and to a lesser degree to the internist and cardiologist. It will also be useful to many of the other specialties. The general practitioner will definitely profit by having this volume in his library and it is well worth reading by all physicians.

—*RALPH D. ROSS, Capt., MC, USN*

Principles and Technics of REHABILITATION NURSING, by *Florence Jones Terry,* B. A., R. N., P. T., O. T. R.; *Gladys S. Benz,* R. N., M. A.; *Dorothy Mereness,* R. N., M. A.; *Frank R. Kleffner,* Ph. D.; and *Deborah MacLurg Jensen,* R. N., M. A. (Editor). 345 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., 1957. Price $5.50.

This textbook, written by multiple authors, is a nice presentation of the many problems in rehabilitation. The authors, except for one, are all registered nurses who have had considerable experience in this field. Florence Jones Terry, the senior author, is a registered nurse, a physical therapist, and an occupational therapist as well. She was former chief nurse at the Institute of Rehabilitation and Physical Medicine, New York Bellevue Medical Center. She calls upon her wide experience in formulating the major portion of this book. While the application of many principles utilized in physical rehabilitation are not always described in detail, there is considerable information in this text. It is certainly a concise and well-written book. It brings the team approach to the problem and highlights the basic philosophy that rehabilitation pays for itself.

I am sure the material on specific conditions, such as hemiplegia, arthritis, et cetera, will prove to be of great value to all interested in these problems. Likewise of considerable interest were the chapters on amputees and "Growing Through Illness." The latter because of the fact that the nurse plays a most important role in individualizing the management of illness in children. If there is any weakness in this book it is a lack of further, detailed information on the handicapped child. This chapter is adequately covered from a psychiatric standpoint.

This book is recommended to all who are interested in rehabilitation and, since each chapter has excellent questions for review as well as references, I believe it is a good textbook for both physical therapists and nurses in training.—*EMMETT M. SMITH, Col., MC, USA*

PEDIATRIC DENTISTRY, by *M. Michael Cohen,* D. M. D. 607 pages; 395 illustrations including 9 in color. The C. V. Mosby Co., St. Louis, Mo., 1957. Price $14.75.

This book is a composite of 17 chapters dealing with oral health in children. It is presented by many of the leading authorities in this field. It begins with the embryologic development of the head, face, and oral cavity, and describes the physical and psychologic development of the child.

There is a very informative chapter on craniometry and cephalometry as applied to the growing child, and the sections on operative and surgical problems in childhood are excellent. The need for special training and equipment in dealing with handicapped children is lucidly described, and its importance with the present population growth is emphasized. The magnitude of this problem can be realized when one considers the fact that there are over 550,000 cases of cerebral palsy in this country. Inadequate dental treatment adds an additional burden to the already handicapped child, as well as an additional cost to the parents and welfare organizations.

The photographic reproductions are good, illustrate the subject matter well, and were carefully selected. The roentgenographic illustrations are clear and have lost only minimal detail in reproduction. The sequence of topics discussed lend to continuity of the text, and there is a current and detailed bibliography at the end of each chapter from which the authors have reported the latest developments.

This book has been designed in an attractive and readable form, and the type, size, paper, and binding make for ease in reading. The fact that the book is made up of contributions from many outstanding clinicians makes it an excellent reference book for anyone interested in the health and well-being of the child. It is a most worthy contribution to pediatric dentistry, a field upon which insufficient emphasis has been placed.—*RICHARD J. BURCH, Col., USAF (DC)*

SYNOPSIS OF PATHOLOGY, by *W. A. D. Anderson,* M. A., M. D., F. A. C. P., F. C. A. P. 4th edition. 829 pages; 328 text illustrations and 12 color plates. The C. V. Mosby Co., St. Louis, Mo., 1957. Price $8.75.

The fourth edition of this book brings up to date one of the best texts to date on general pathology.

The title "Synopsis" is misleading because most pathologic conditions are adequately discussed and explained. The photographs, mainly in black and white, show excellent detail and properly illustrate the text. The references listed at the end of each chapter cover the recent literature and also older classic articles.

This text is highly recommended for anyone interested in general pathology.—*VERNON E. MARTENS, Capt., MC, USN*

PRACTICAL PSYCHIATRY FOR INDUSTRIAL PHYSICIANS, by *W. Donald Ross,* M. D., B. Sc. (Med.), F. R. C. P. (C). Foreword by *Robert A. Kehoe,* B. S., M. D. Preface by *Maurice Levine,* A. M., M. D. 401 pages. Charles C Thomas, Publisher, Springfield, Ill., 1956. Price $7.50.

In the foreword to this excellent text, Dr. Robert A. Kehoe, professor of Industrial Medicine at the University of Cincinnati notes that Dr. Ross "has responded to the needs of a new generation of industrial physicians by producing a source book from which they can obtain encouragement, advice, and useful technical information . . . . The scope of the applications of psychiatric principles and methods in industrial medicine thus revealed comes as an exciting surprise." Physicians in all branches of occupational medicine, military or non-military, will welcome this book in the same spirit as Dr. Kehoe.

The author first considers fundamental attitudes and basic technics, which are presented in terms richly interwoven into the occupational setting. The reader is prepared for later material by highly condensed, meaty presentations of interviewing and examination, diagnosis, psychologic and social aids, psychotherapy, and physical aids. Problems of neurologic diagnosis and evaluation of mental status are particularly well handled. Special attention is devoted to the criteria the practitioner uses to determine whether a person requires the services of a psychiatrist, general physician, or a social agency. In a section entitled "Cooperation," the author reviews the position of medicine in the industrial social system. Reference is made to the great part played by medical services in the Armed Forces in developing industrial medicine.

Absenteeism, accidents, alcoholism, disability, motivation, rehabilitation, and fatigue receive careful analysis, along with many other subjects to which psychiatric "know-how" can make a critical contribution. Psychosomatic disorders, including injuries to head and back, neurocirculatory asthenia and occupational dermatoses are very well covered. Dust exposure contains some of the author's previous study of this problem both from a statistical and clinical standpoint. Throughout this discussion of detailed problems, the role of the industrial physician as a participant-observer of the problems of executives, foremen, supervisors, and women in industry is defined.

Dr. Ross's book is based on his participation since 1948 in the training program for industrial physicians developed by the Kettering Laboratory. The beginnings of this work go back even further into the author's extensive experience in military psychiatry in World War II. There is a distinct challenge to all career military medical officers: when the fighting stops, psychiatric lessons have been repeatedly mothballed and forgotten. In this book, the author has restructured the hard-learned lessons of people at war and applied them to people at peacetime work. Those who read his book will recognize its integrity and permanence.—*JOHN C. MEBANE, Lt. Col., USAF (MC)*

NEW AND NONOFFICIAL REMEDIES 1957, Containing Descriptions of Drugs Evaluated by the Council on Pharmacy and Chemistry of the American Medical Association. An Annual Publication Issued Under the Direction and Supervision of the Council. 582 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., 1957. Price $3.35.

This annual publication of the Council on Pharmacy and Chemistry of the American Medical Association contains descriptions of drugs evaluated on the basis of available scientific data and reports of investigations. It deals with agents proposed for medicinal or adjunctive use in or on the human body for the diagnosis, prevention, or treatment of disease.

Descriptions of drugs are presented under nonproprietary names in the form of monographs designed to provide the following information: chemical or biologic identity, including pertinent properties; actions and uses, including associated side effects, toxicity, and precautions; and dosage, including routes of administration. Monographs are arranged alphabetically according to their nonproprietary titles and are grouped under chapters according to pharmacologic action or clinical use.

This is the second annual publication under the Council's revised program of operation for evaluation of drugs in which the scope of the book no longer is restricted only to descriptions of drugs having established uses but has been expanded to provide for inclusion of information on all available new drugs. More emphasis on basic information has been accomplished by the elimination of dosage forms and sizes, the names of manufacturers, and monographs describing ready-prepared mixtures of two or more drugs. Forty-two monographs have been added for drugs evaluated since the previous edition.

In the opinion of the reviewer, this annual publication is a valuable reference for physicians and pharmacists.

—*HENRY D. ROTH, Lt. Col., MSC, USA*

DISEASES OF THE HEART AND CIRCULATION, by *Paul Wood*, O. B. E., M. D. (Melbourne), F. R. C. P. (London). 2d edition. 1,005 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., 1956. Price $15.

In the first edition (1950), Dr. Wood, Director of the Institute of Cardiology, London, sought "to maintain a proper balance between man and his instruments, between experienced opinion and statistics, between traditional views and the heterodox, between bedside medicine and special tests, between the practical and the academic; and so to link the past with the present." The second edition, on the other hand, is written to elaborate the newer investigatory technics, physiologic concepts, plus medical and surgical treatment. The author has succeeded admirably in attaining his objectives.

The text is arranged logically on a physiologic and etiologic basis. Each chapter ends with a fairly lengthy list of references which will be of value to the inquisitive mind. The opening chapters on the chief symptoms of heart disease and physical signs serve as an excellent entree to the diagnostic and investigative procedures that follow. The

chapter on electrocardiography is succinct and lucid; however, the British method of mounting the electrocardiogram in relation to the Einthoven triangle tends to slow up the reader trained to analyze tracings by studying limb leads and precordial leads in separate groupings. Although the triaxial reference system is explained in determining the vector axis, no mention is made of the hexaxial reference system which lends itself more readily to vector force analysis. The chapter on special investigations should enable the practitioner to comprehend much of the spate of literature in this field. Of the remaining chapters that are written with considerable clarity, the ones on ischemic heart disease and hypertensive heart disease are outstanding. In view of Burgess' report in 1956, one might question the prognosis given in uncomplicated benign hypertension. The reviewer concurs with the author that this book is of value primarily for graduates interested in clinical cardiology and can meet the needs of students, general practitioners, and specialist physicians in other fields of medicine.

In summary, this textbook makes an ideal companion piece to the books of Paul D. White and Charles K. Friedberg.

—ARCHIE A. HOFFMAN, Col., USAF (MC)

BASIC FOUNDATIONS OF ISOTOPE TECHNIQUE For Technicians, edited by *Willard C. Smullen*, M. D., F. A. C. R. 163 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1956. Price $4.75.

The editor has attempted to provide a book containing the basic background of isotope technic for medical technicians. As such he has accomplished his mission.

The material presented is based on a series of lectures by accepted authorities given as a course for technicians. The editor states that tape recordings of the original lectures were used as a basis for some of the material. Although this technic is worthwhile, in that the presentation is thus pretested as to clarity and understanding on the part of the beginners in isotope procedure, it has the disadvantage of an occasional lapse in orderly presentation of the material. The basic fundamentals presented have been designed for personnel of the technical rather than the professional level.

A good background knowledge for the understanding of the technical procedures in the use of radioisotopes in medicine is provided with clarity and completeness. These procedures are discussed in a general way, more to provide background information than to assure a "cookbook" type of presentation. The illustrations, some of which are drawn from commercial sources, are adequate.

A glossary and appendix are included. The bibliography, although not extensive, contains most of the classic available literature related to the discussions.

This book provides a source of basic knowledge in a field so far neglected for technicians. As such it is worthwhile.

—EDWARD A. LANGDON, LT. Col., MC, USA

New Books Received

Books received by the *U. S. Armed Forces Medical Journal* are acknowledged in this department. Those of greatest interest will be reviewed in a later issue.

A NAVY SURGEON IN CALIFORNIA, 1846-1847, The Journal of Marius Duvall, edited by *Fred Blackburn Rogers.* 114 pages. Published by John Howell, San Francisco, Calif., 1957.

ESSENTIALS OF CLINICAL PROCTOLOGY, by *Manuel G. Spiesman,* M. D., B. S., L. L. D., F. I. C. P., and *Louis Malow,* M. D., B. S., F. A. C. S. 3d edition. Grune & Stratton, Inc., New York, N. Y., 1957. Price $8.75.

LOCAL ANESTHESIA AND PAIN CONTROL IN DENTAL PRACTICE, by *Leonard M. Monheim,* B. S., M. S., D. D. S. 299 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., 1957. Price $8.75.

THE YEAR BOOK OF ORTHOPEDICS AND TRAUMATIC SURGERY (1956-1957 Year Book Series), edited by *Edward L. Compere,* M. D., F. A. C. S., F. I. C. S. 336 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1957. Price $6.75.

THE LEUKEMIAS: Etiology, Pathophysiology, and Treatment. Edited by *John W. Rebuck, Frank H. Bethell,* and *Raymond W. Monto.* A Henry Ford Hospital International Symposium. 711 pages; illustrated. Academic Press, Inc., New York, N. Y., 1957. Price $13.

ORAL DIAGNOSIS AND TREATMENT (Oral Medicine), A Textbook for Students and Practitioners of Dentistry and Medicine, by *Samuel Charles Miller,* D. D. S., F. A. C. D., F. A. D. M., and 37 contributors, with an introduction by *Raymond J. Nagle,* D. M. D., F. A. C. D. 3d edition. 977 pages; 577 illustrations in black and white and 30 color plates. The Blakiston Division, McGraw-Hill Book Co., Inc., New York, N. Y., 1957. Price $16.

FUNDAMENTALS OF MICROBIOLOGY, by *Martin Frobisher,* Sc. D. 6th edition. 617 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1957.

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